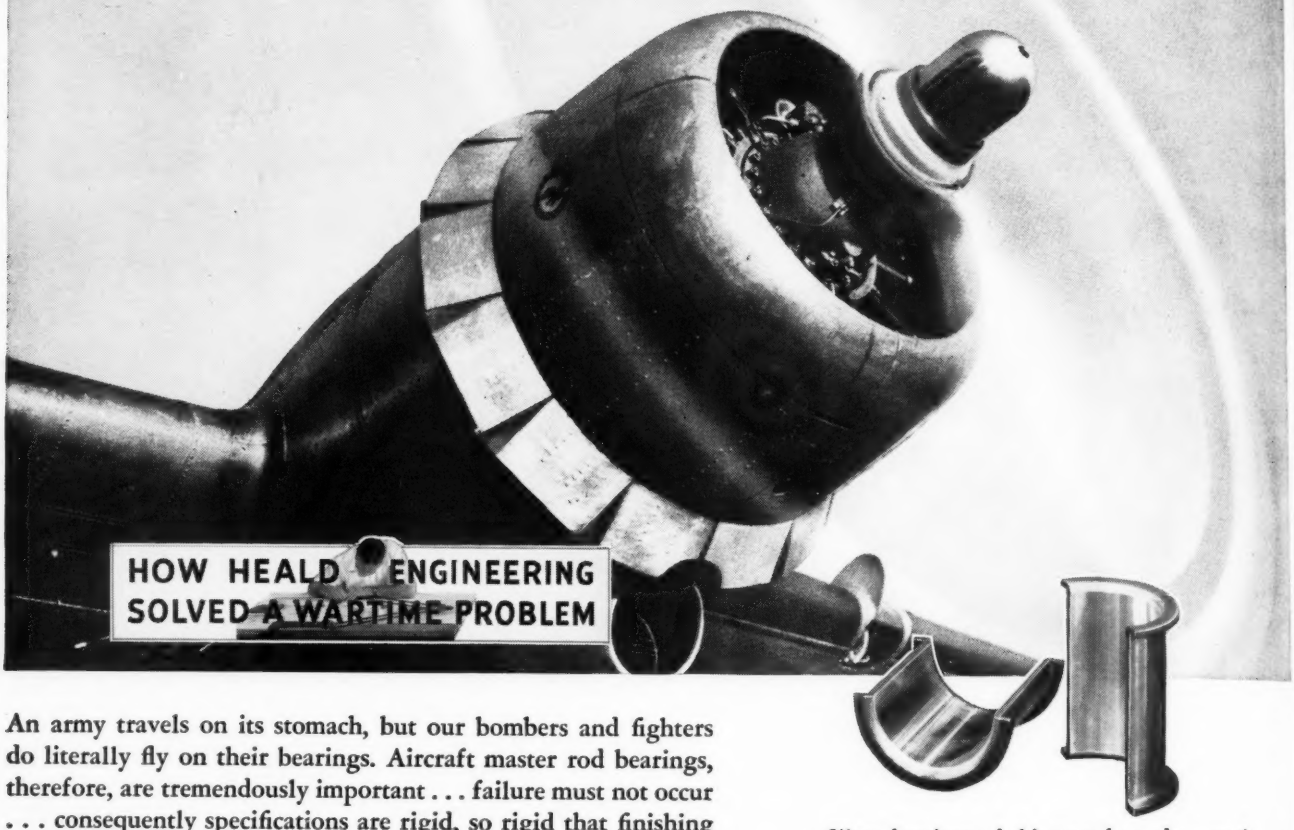
NAVAL CONSTRUCTION NUMBER ★★ NOVEMBER, 1943

MACHINERY

1200 HORSEPOWER Rides On 6 MILLIONTHS of an inch



HOW HEALD ENGINEERING SOLVED A WARTIME PROBLEM

An army travels on its stomach, but our bombers and fighters do literally fly on their bearings. Aircraft master rod bearings, therefore, are tremendously important . . . failure must not occur . . . consequently specifications are rigid, so rigid that finishing presented a pressing wartime problem to the manufacturer.

Surface finish was of primary importance — was vital for bearings to stand up continuously under the merciless buffeting of 1200 and more whirlwind horsepower. Six microinches, the specifications called for, six millionths of an inch. Design, too, specified a very difficult contour bearing surface, with tapers at either end and a straight section between. And accuracy also had to be close, to .0002".

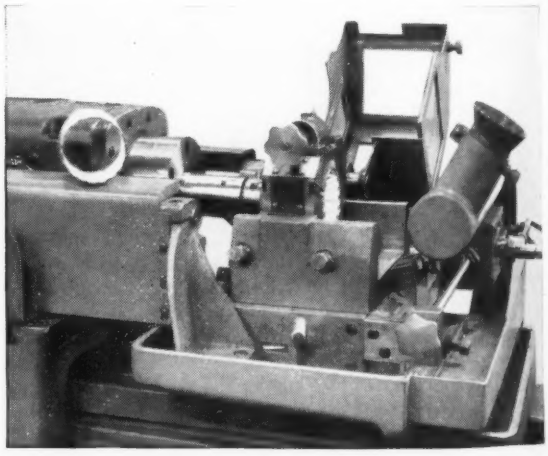
HEALD ENGINEERING was called in . . . and solved the problem. This was a special Heald Bore-Matic arranged with a cam operated contour boring head for boring straight and tapers in a single uninterrupted cut . . . with ingenious refinements in machine design which so completely reduced vibration and thermal expansion that ultra finishes of 4-6 microinches could be produced. Today, a total of 19 Heald Bore-Matics are in production on these bearings in one plant alone.

Have you a wartime problem or do you need assistance in post-war planning? If it involves precision finishing, HEALD ENGINEERING is available, now, to help you.

The HEALD Machine Co., Worcester Mass., U. S. A.

Silver bearings of this type have done much to keep aircraft flying longer, fighting longer. For ultra precision, bearings are borized — to .0002" accuracy, 6 microinches finish.

Precision plus production in finishing aircraft bearings were both achieved with the development of the specially arranged Heald No. 47A Bore-Matic shown below. Machine features include a special contour boring head for boring straight and taper bearing surfaces in the same cut; many design refinements for obtaining surface precision of 4-6 microinches. The Bore-Matic handles both full round and split bearings.



For More Precision Faster, bring your problems to Heald

DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

NOVEMBER, 1943

Our fabulous production of the implements of war and all of our highly trained combat personnel would be of no avail were it not for our huge merchant fleets that transport the vast quantities of supplies needed in the battle areas. The records made in building these fleets under the program of the Maritime Commission stand out as the greatest shipbuilding achievement in history. December MACHINERY will feature mass production methods developed in shipyards that have helped to build the merchant fleets and in industrial plants that produce propulsion equipment. A leading article by Admiral Vickery will outline the shipbuilding achievements already accomplished and the program planned for the future.

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Number 3

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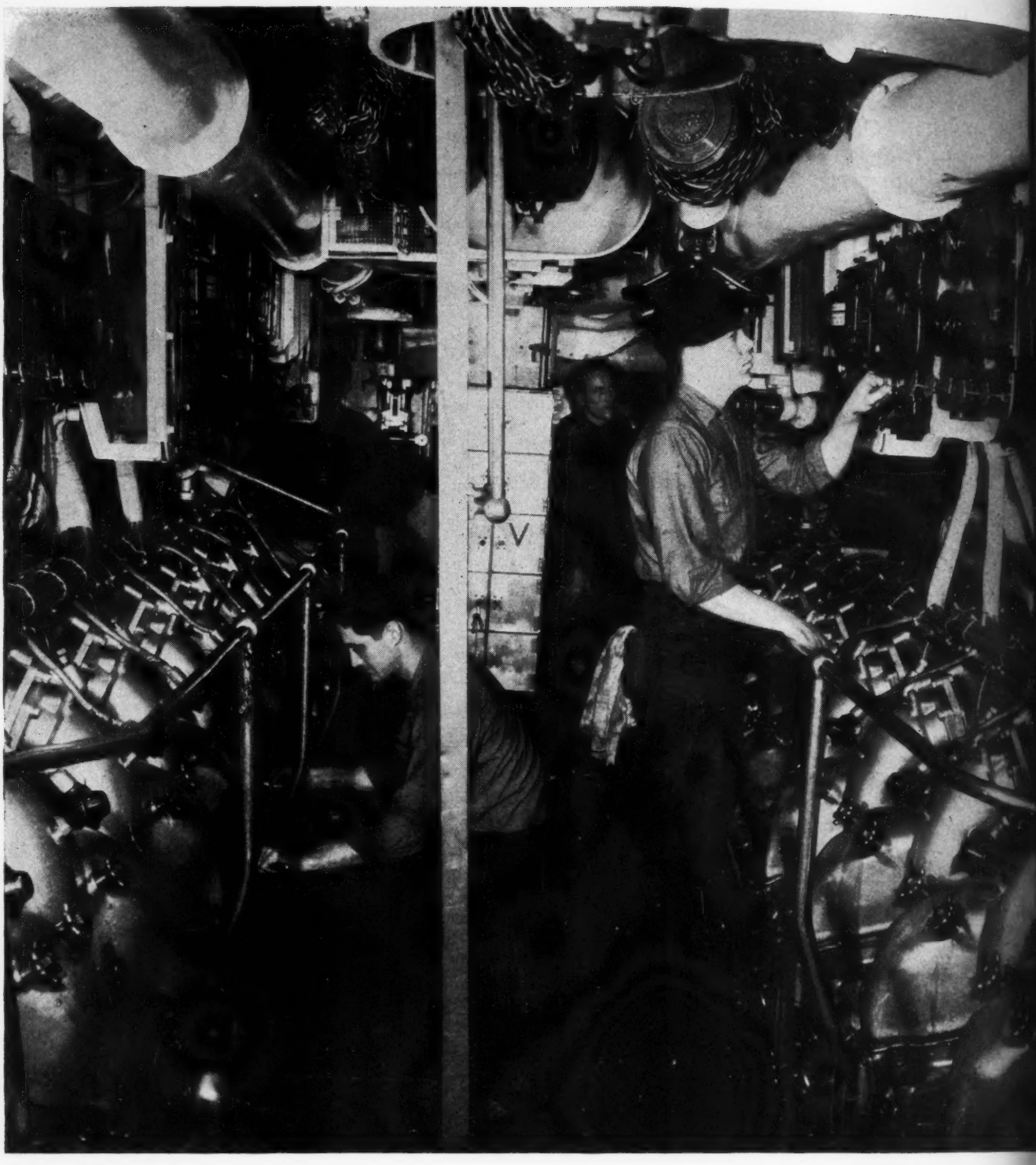
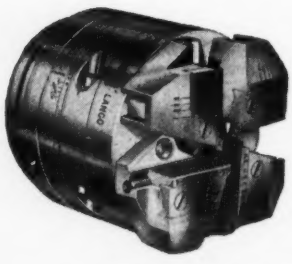


Official U. S. Navy Photograph

American submarines are powered by Diesel engines when operating on the surface. Here machinist mates check the mammoth twin Diesels in the engine room of a U. S. sub.



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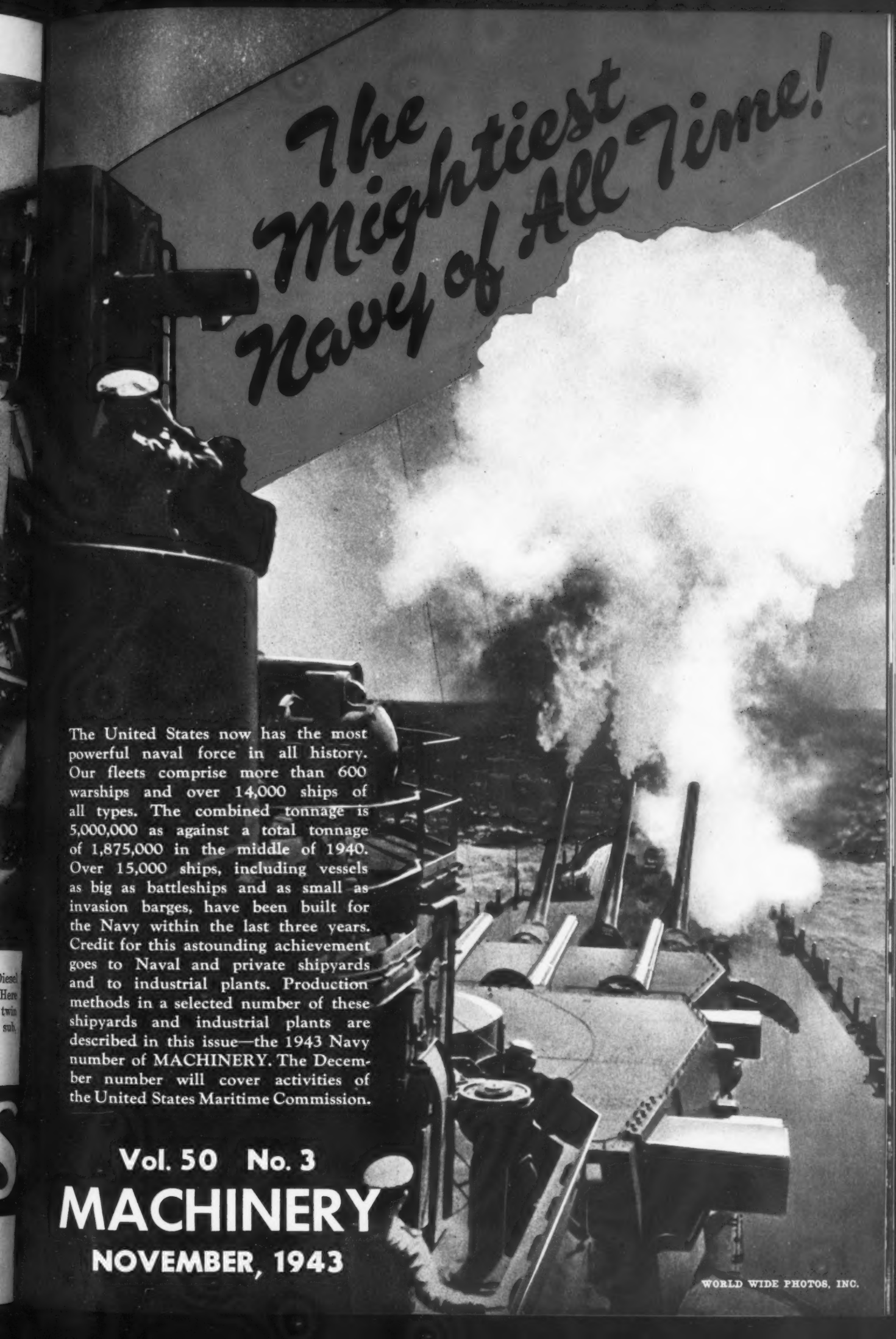


The Mightiest Navy of All Time!

The United States now has the most powerful naval force in all history. Our fleets comprise more than 600 warships and over 14,000 ships of all types. The combined tonnage is 5,000,000 as against a total tonnage of 1,875,000 in the middle of 1940. Over 15,000 ships, including vessels as big as battleships and as small as invasion barges, have been built for the Navy within the last three years. Credit for this astounding achievement goes to Naval and private shipyards and to industrial plants. Production methods in a selected number of these shipyards and industrial plants are described in this issue—the 1943 Navy number of MACHINERY. The December number will cover activities of the United States Maritime Commission.

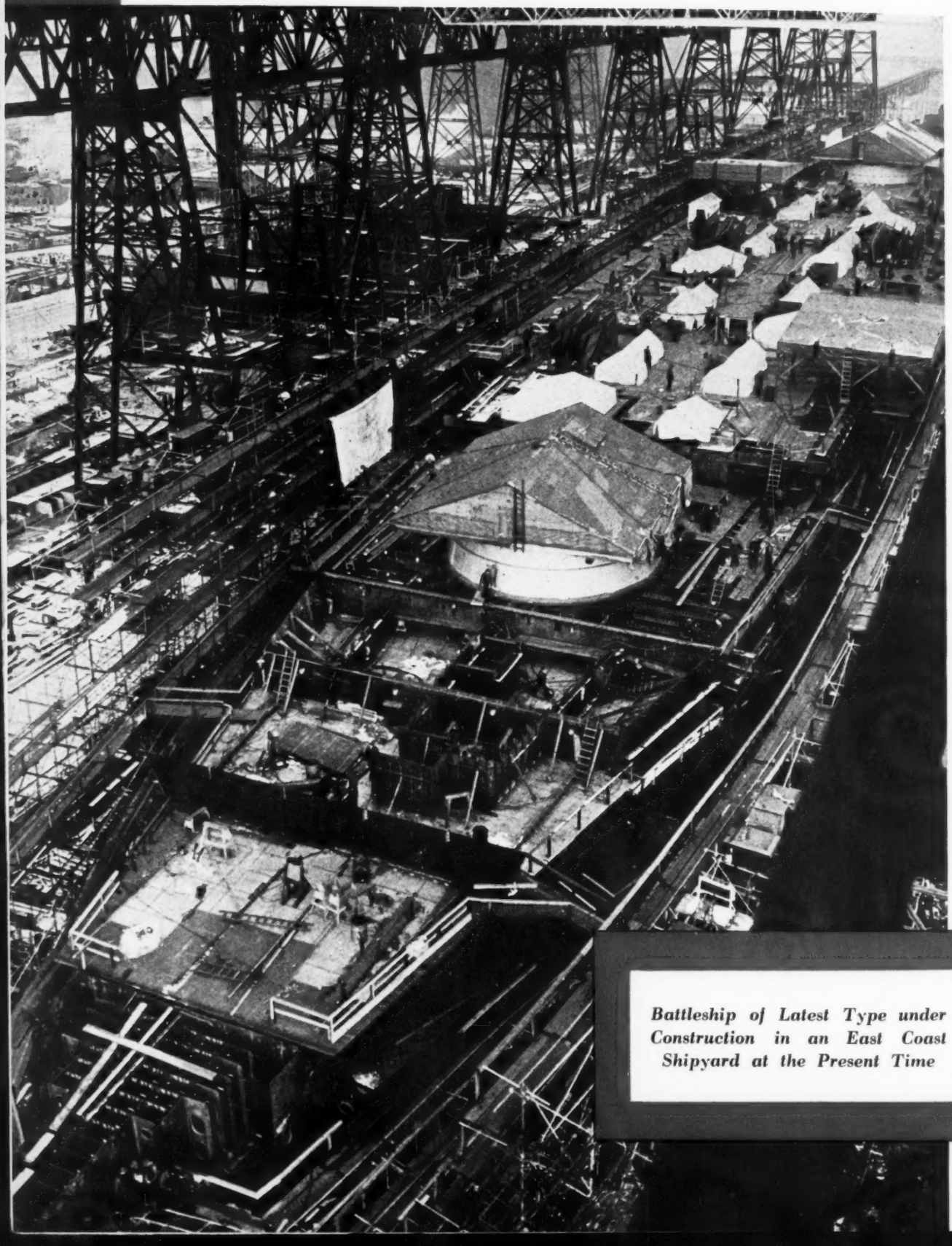
Vol. 50 No. 3

MACHINERY

NOVEMBER, 1943

WORLD WIDE PHOTOS, INC.

Building and
THE GREATEST NAVY



Battleship of Latest Type under Construction in an East Coast Shipyard at the Present Time

Maintaining IN HISTORY

By REAR-ADMIRAL E. L. COCHRANE
Chief, Bureau of Ships
United States Navy Department

PHENOMENAL records in ship construction and repair are being made on American shipways today, both in Government-owned and private yards. The "impossible" is being done—an achievement made possible, first, by the devotion to duty of men and women workers (many of whom have never seen the sea), and second, by the all-out cooperation being given shipbuilders by American industry as a whole. The joint efforts of individuals and industry have been inspired, of course, by the realization that a United Nations victory depends, to a great extent, upon the ability to keep our guns firing and our ships moving.

Once again, as in all previous wars this country has been dragged into, we were woefully unprepared on December 7, 1941—the Japanese gained a tremendous initial advantage by their well executed attack on Pearl Harbor. Even with assistance from our Allies, there were not enough fighting ships, auxiliaries, and other shipping facilities to hope or expect to hang on to what we then possessed. Thus it became a primary but difficult task to allocate available facilities, delay our enemies as much as possible while contracting our lines, and accept as few sacrifices as possible. The enemies, although underestimating our industry and resources, were striving for a knock-out blow before our potentiality could be felt. They were thwarted at Coral Sea, quickly followed by Midway, where they must have learned with a shock how su-

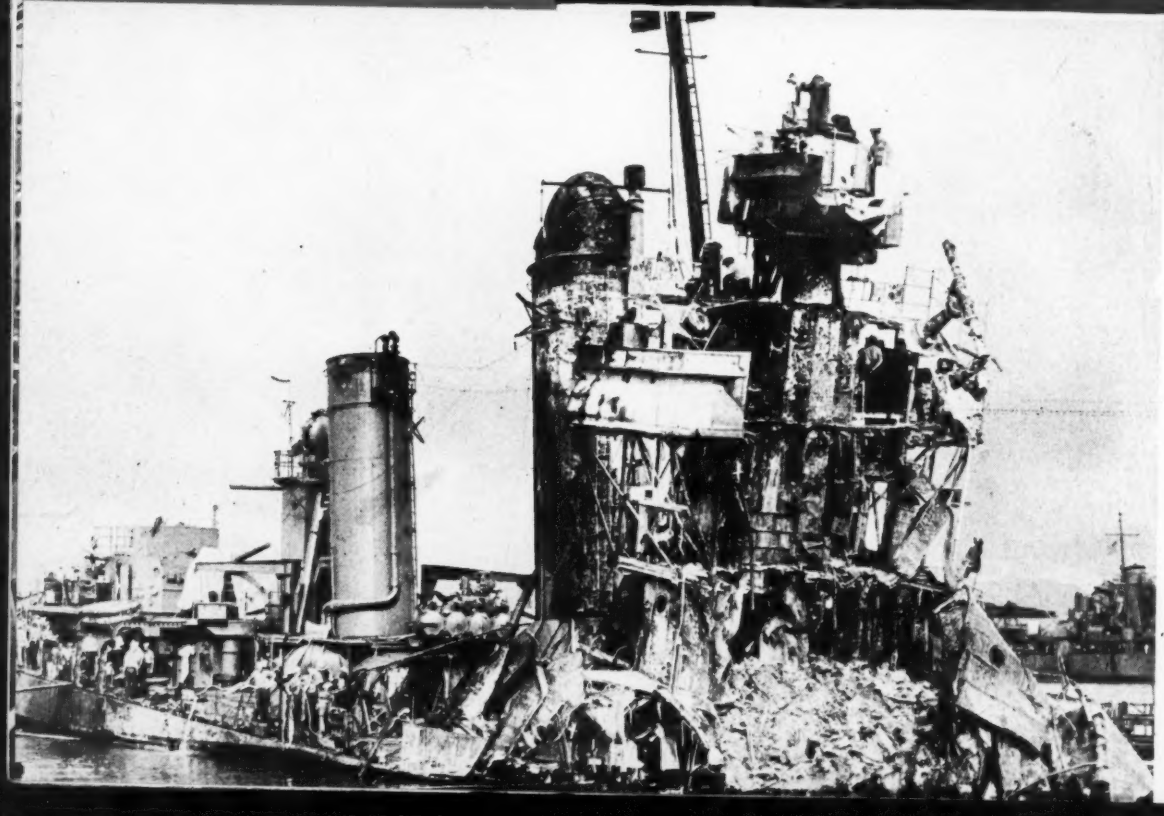
REAR-ADMIRAL E. L. COCHRANE

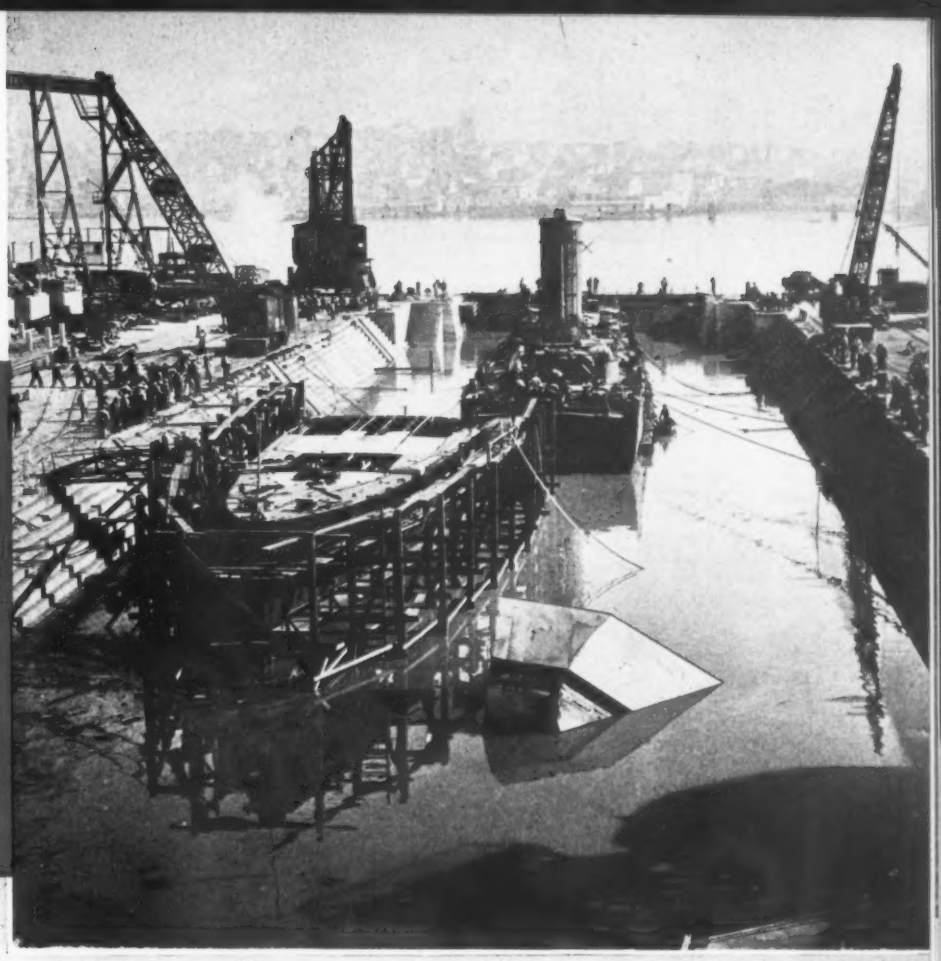
All illustrations in this article are official U. S. Navy photographs.

(Left) Hit by Three Japanese Bombs, the Forward Magazine of the U. S. S. Shaw Explodes at Pearl Harbor—One of the Most Dramatic Combat Photographs of All Times

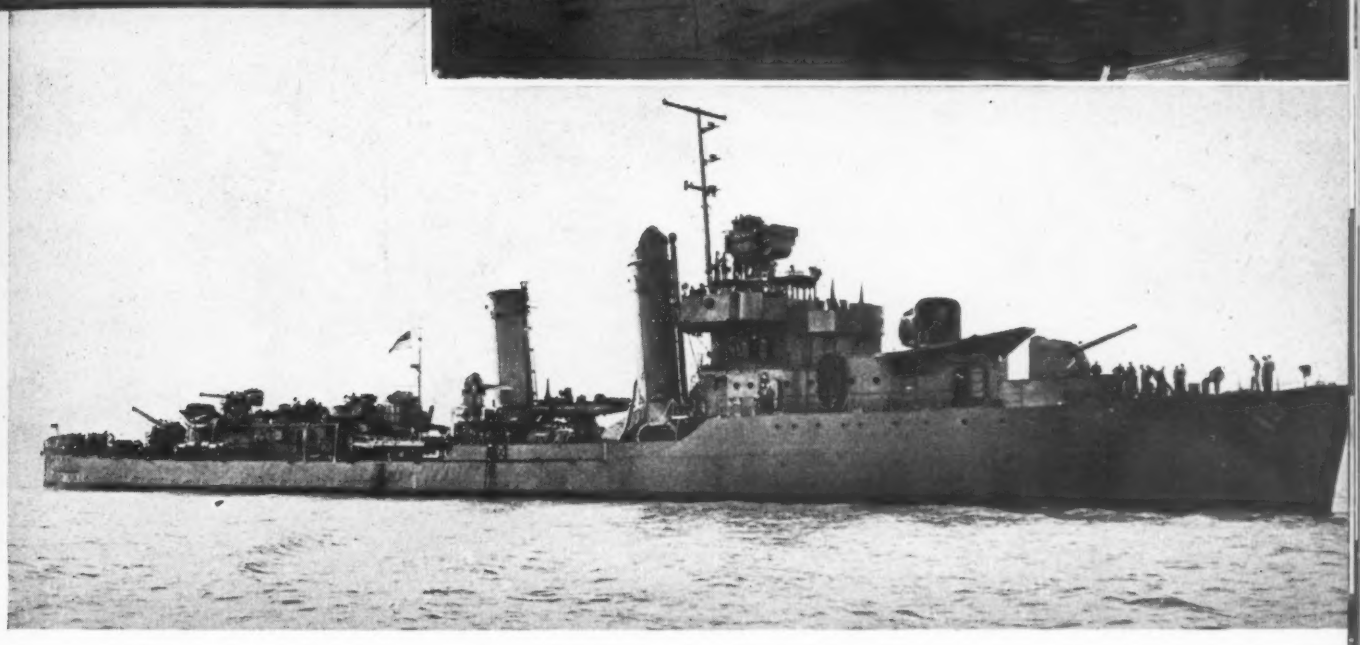
(Right) The 1500-ton Destroyer Shaw Lies a Twisted Mass of Wreckage in a Heavily Bombed Floating Dry Dock. The Bow of the Shaw is Seen Lying on Its Side in the Foreground

(Below) Close-up View of Tangled Wreckage of the Destroyer Shaw after the Smoke and Flames of Pearl Harbor Had Died Away





(Right) A False Bow Built on the Shaw at Pearl Harbor Permitted Her to Proceed under Her Own Power to a West Coast Shipyard. This Photograph Shows the Shaw in This Shipyard with Workmen Maneuvering the New Bow into Position

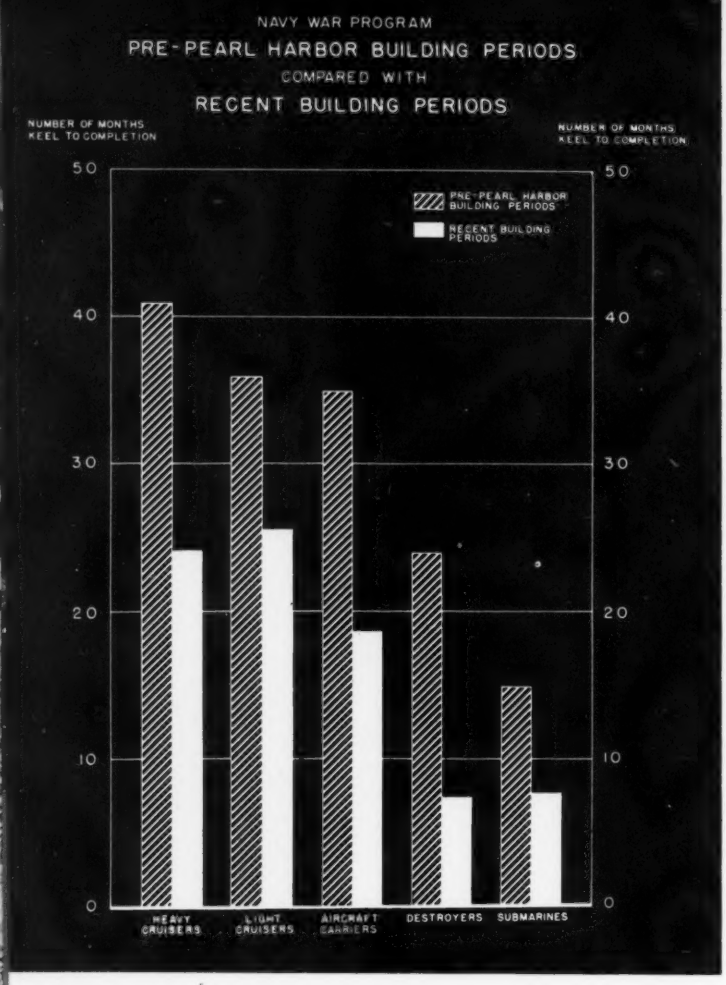


(Below) The U. S. S. Shaw Completely Repaired Steams Away on Another Battle Mission

perior our men and equipment were to theirs. They were yet by no means ready to go on the defensive, for they realized that this inevitably would lead to defeat.

It is not the Japanese way to give up easily, and despite the set-backs at Coral Sea and Midway, they still were in a strong position. Their merchant tonnage was more than equal to the task of supplying their outlying forces. It was up to their fighting ships to destroy ours before increased production in this country could assert itself, even at the cost of accepting greater losses than were inflicted. They were thwarted in this objective in the many actions centering around the Solomon Islands in which our ships, aided by air power, inflicted heavier damage to the enemy than even many Americans believed possible when the situation appeared so depressing.

We were not without serious troubles ourselves, however. In the Atlantic, in the Caribbean, even within sight of our own shores, Nazi submarines were taking their toll. The ocean thoroughfares to Russia were littered with the wreckage of American and United Nations



ships. Axis leaders were jubilant; the air was filled with their boasts that America would never be able to send invasion forces to Europe, or even to keep England from starving. Obviously and admittedly, herculean efforts were required to meet the situation. How successful these efforts were, is best borne out by examining the record.

But first, let us take a look at the problem. The primary function of our Naval Shore Establishment is to provide service to the Fleet. The Navy Yards perform a vital part of this service in keeping our fighting ships fit and ready for service, providing them with the latest types of fighting equipment, and healing their wounds after battle. Today, not only are the yards doing notable work in building new ships, but they must be and are ready at all times to care for the ships on the fighting line. In times of peace this maintenance function is fulfilled by the assignment of ships to home yards, where they return at regular intervals for well defined overhaul periods which are assigned many months in advance. On this basis, the work at the yards can be scheduled in an orderly manner and a fairly constant working force employed on this type of work. The larger Navy Yards in peacetime ordinarily employ from 5000 to 7000 men, working forty hours a week with a little shift or over-time work.

After Pearl Harbor an entirely new situation had to be met. All ships had to be brought to their highest state of efficiency and maintained there. New developments in weapons and instruments had to be rushed through production and be installed. Extended cruising in convoy and other work placed a new emphasis on maintenance, but the time allowed for this in the yards was sharply curtailed. Then came the battle damage repair jobs which had not and could not be scheduled.

To meet this situation, our Navy Yard working forces were doubled, tripled, and quadrupled, as fast as men could be recruited. When skilled men were no longer available, untrained men and women were brought in to work alongside the skilled until they could pick up their share of the work load. As an example, the force at one of our East Coast Navy Yards expanded from 1500 men in 1937 to 26,000 in 1943. One of our larger Navy Yards now employs over 69,000 men and the forces are still increasing in some areas.

Getting the ships damaged at Pearl Harbor back into service was a large order. Workers were recruited, at first largely from the mainland Navy Yards, for this task. Pearl Harbor Yard grew, like a mushroom, almost overnight to many times its former size. The workers were subjected to inadequate accommodations, and were separated from their families and friends, but ungrudgingly accepted these conditions. The Japanese can testify as to the effectiveness of their work.

As the size of the Navy increases, this repair load grows in direct proportion. On December 1, 1941, just before Pearl Harbor, there were less than a thousand ships in commission in the Navy. On July 1, 1943, this number was approaching four thousand, excluding landing craft. During one month of this year, there were 436 naval vessels under repair in nine Navy Yards; work costing a total of $20,000,000 was accomplished on these ships. Most of this repair work is done on the basis of returning the ships to the Fleet at the earliest practicable date; to accomplish this, full-shift work and over-time is employed. In many cases where important units of the fleet were needed by specified dates, the yard personnel have virtually accomplished the impossible in meeting the deadline. There are many unsung heroes among our shipyard workmen and foremen who have worked long hard

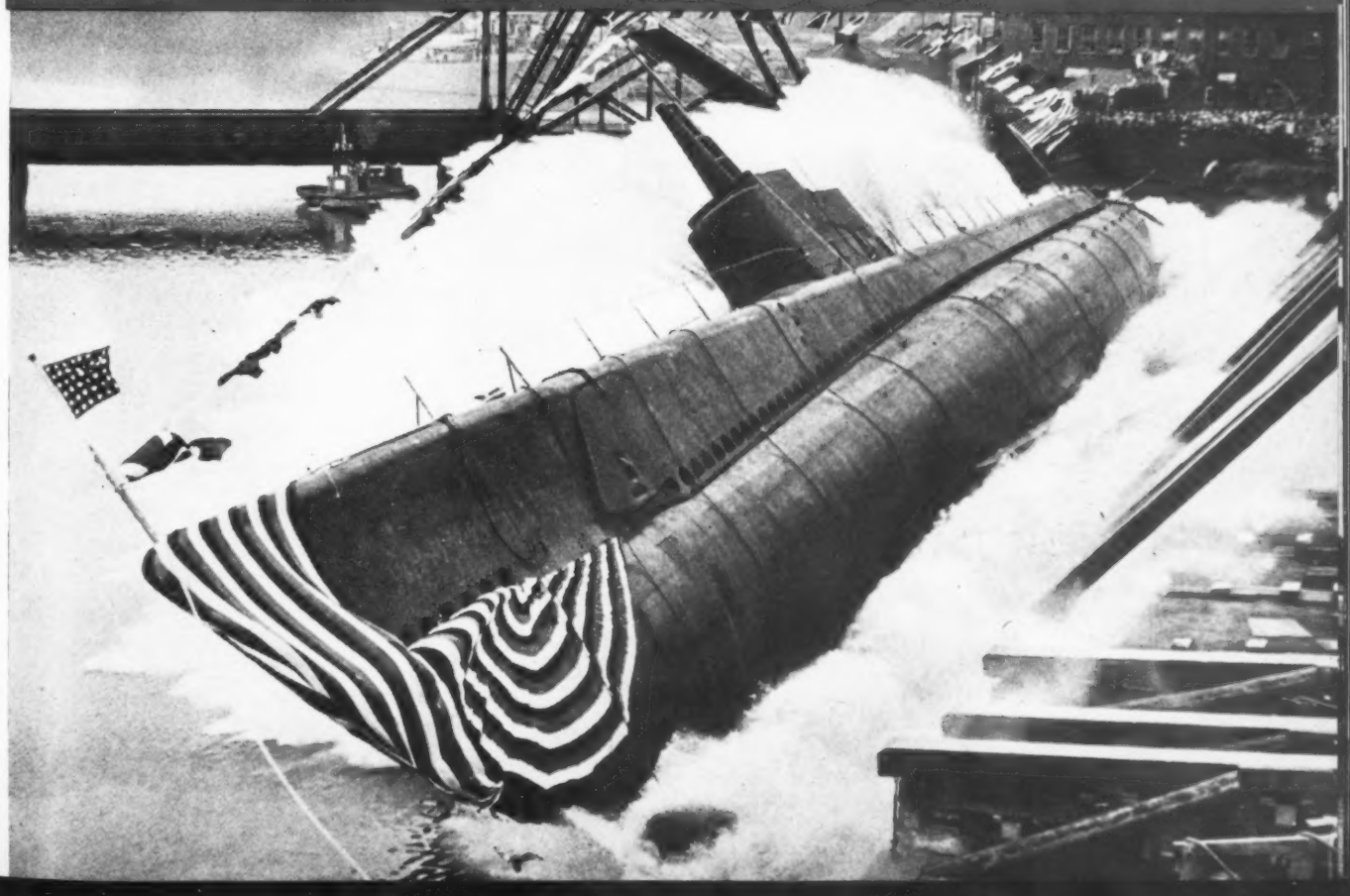
hours without benefit of blueprints to get a ship back to the battle line in record time.

Some notable jobs have been done in repairing ships that were badly damaged in battle. Well known to the public are the cases of the *Shaw* and the *San Francisco*. The former, which lost everything forward of her No. 1 stack at Pearl Harbor, was fitted with a false bow and steamed to Mare Island under her own power, where a new bow was waiting in drydock. The false bow was removed and the new one installed, and all other repairs completed in less than four months. The *San Francisco* was restored after her battering in the battle of Guadalcanal in a period of two months, a better ship than when she entered the battle.

As the repair load began to grow by leaps and bounds, it became evident that our Navy Yards would not be able to handle all of the work on naval vessels, and plans were made to make use of private ship repair yards. There were many difficulties to overcome in setting up this program, due to the unfamiliarity of the private yards with Navy specifications and standards, but they were overcome by the hearty cooperation of the shipyard personnel, Naval inspectors and ships' officers. Most of these yards have now passed the educational stage and take Navy work in their stride. The extent of this program is indicated by the fact that during one month of this year there were 418 U. S. and foreign naval vessels undergoing overhaul or conversion in private yards in this country.

Actually a sizable part of the work undertaken in our yards, both Government and private, has been the overhaul and repair of foreign warships. During the past year this work constituted 17 per cent of the total repair load, and involved an expenditure of approximately $60,000,000. In all, eighty-three large ships were repaired for ten Allied nations, the majority being British. This work, especially in the beginning, taxed the resourcefulness of our yards in adapting U. S. methods and materials to the requirements and specifications of foreign naval services. The use of different names for the same article by the U. S. and British Navies did not help the situation. Our workmen had to learn that an elevator on a British ship is a "lift," that a wire is "earthed" rather than grounded, that a "bird cage" is a radar shack, and that a "wandering lead" is a portable cable.

Submarine being Launched at an Inland Shipyard—Built by Workmen of Whom Few have Ever Seen the Ocean PAGE 137



Born of American Ingenuity, Tank-Landing Craft have Aided the Allied Cause in All Parts of the World where Battle has been Carried to the Foe

Many unusual problems have arisen during the repair of damaged ships for which there was no precedent, and the yards have displayed unusual resourcefulness and ingenuity in solving these. As an example, a ship arrived at a West Coast Navy Yard for repair of damage caused by an explosion in one of her gasoline tanks. The deck plating had been forced downward in such a way as to block acccess to the damaged gasoline piping. It had not been practicable to remove all gasoline in the area, and some preliminary cutting away was necessary before steaming of the tanks could be undertaken. The yard was therefore faced with the problem of cutting away the plating in an explosive atmosphere.

The problem was solved by flooding the compartment with water, and sending down a diver to cut away the plating with underwater cutting equipment. The cut plating was then removed and the water pumped down. As the arc type of underwater cutter was not available, the gas type was used. This necessitated lighting the torch on the forecastle deck and lowering it to the diver in a bucket of water. As a further precaution, the bucket and torch were kept in a fog spray until the torch was submerged. Access was then had to the damaged piping. During the work of removing the piping, it became necessary to do some chipping. This was accomplished by putting a chipper in rain clothes, and he accomplished the necessary chipping enveloped in a fog spray from a conventional fog nozzle. Having completed this preliminary clearing away, the steaming and gas freeing of the tanks proceeded.

A cruiser had her bow blown off by torpedoes to a distance of 80 feet from the stem. While the ship was undergoing temporary repairs to permit her to reach a Navy Yard, work was started on a new bow in the yard shops. Twenty-five days later when the ship arrived at the yard, a new bow section had been completely assembled and set up in drydock. Within two weeks of her arrival the new bow was installed and the ship could be undocked.

The new bow was constructed in the shop in three units, by dividing the bow into three horizontal layers. Each of these were later cut into two sections to permit handling by yard cranes. The upper units were built in an inverted position to permit "down welding" of beams and bulkheads to decks.

BUILDING AND MAINTAINING THE GREATEST NAVY IN HISTORY

Operations of our ships under war-time conditions have resulted in some cases of severe damage from collision. A modern destroyer was cut almost in half by another vessel, the bow penetrating between the two boilers to within six feet of the center line. The keel was knuckled and the forward part out of line with the after part to the amount of 3 1/2 feet at the bow. The stern section was also twisted relative to the bow section. Attempts to straighten the ship when resting lightly in the docking blocks failed, and it was decided to cut the ship completely through, realign the sections and join them again. As the forward section was unstable by itself, this was ballasted and strapped to the dock floor. The after section was then floated, aligned, and listed to correspond with the forward section, and then landed on the blocks. When the repairs had been completed, the work had been so skillfully accomplished that it was not necessary to re-machine the gun foundations, as these were within tolerable limits of parallelism.

Recently one of the Navy's cargo ships sustained serious underwater battle damage caused by a torpedo explosion. Repairs were accomplished by a Navy Yard in a remarkably short time, due not only to the efficient work of the yard, but also to the excellent preliminary damage surveys and work lists forwarded by the vessel from overseas only a few weeks after the occurrence of the casualty. As a result of the submission of the preliminary and revised work lists of necessary repairs and material, it was possible for the yard to order and have on hand, upon the arrival of the vessel, more than a million dollars worth of material consisting, in part, of 900 tons of structural steel. This made it possible to drydock the ship immediately upon her arrival and accomplish all repairs within two months after that date.

Up to the start of the war, lessons learned from battle damage to combatant ships whenever obtainable were carefully analyzed and made as applicable as possible in current construction and in alterations to ships of our operating fleet. In order to increase production rates, and to take care of the design of new classes of craft (which experience was indicating daily would be required) design of ships was frozen, in so far as practicable, so that

(Concluded on page 179)

New Destroyer Escort Vessels Built in a Shipyard that did Not Exist at the Time of Pearl Harbor—Even on Paper

PAGE 139

BOSTON NAVY YARD

Navy Activities Consist of More than Winning Glorious Victories at Sea—Behind Our Fleets are the Navy Yards, which Keep the Ships in Fighting Trim and Build New Men-of-War to Increase Our Fighting Strength

By COMMANDER W. D. SNYDER, U.S.N.
Shop Superintendent, Boston Navy Yard
Boston, Mass.

Official U. S. Navy photo

in Time of War

THE most important function of a Navy Yard in time of war is to keep our fighting fleets ready for active service. This necessitates adequate facilities for quickly repairing ship damage such as normally occurs during long periods of sea duty and also damage resulting from actual conflict in battle. All of the United States Navy Yards have been performing exceptional service in maintaining our fleets at a high peak of efficiency, and in addition, have broken all past records for constructing new fighting vessels.

The outstanding job done by the Boston Navy Yard in producing new ships and fittings, as well as in keeping damaged craft and equipment in repair, was recently referred to by Assistant Secretary of the Navy Ralph A. Bard when he praised its employes on making theirs the first Navy Yard to receive the third star on its Army-Navy "E" flag. In addition to this, the thousands of workers at the Boston Yard have found a source of great pride and inspiration in the special telegrams of commendation received by some of the shops individually from Rear-Admiral Edward L. Cochrane, USN, Chief of the Bureau of Ships in the Navy Department, since the all-out war program got under way.

To the Boston Navy Yard was assigned the task of building destroyers, destroyer escorts, and submarines to augment our fleets, plus a far greater amount of maintenance work than had ever been scheduled to this yard during its entire history. These vast activities necessitated important expansion of manufacturing facilities, which led to the development of a second shipyard across the bay from the original yard. This addition comprises approximately 100 acres of filled-in land reclaimed from the bay, and is

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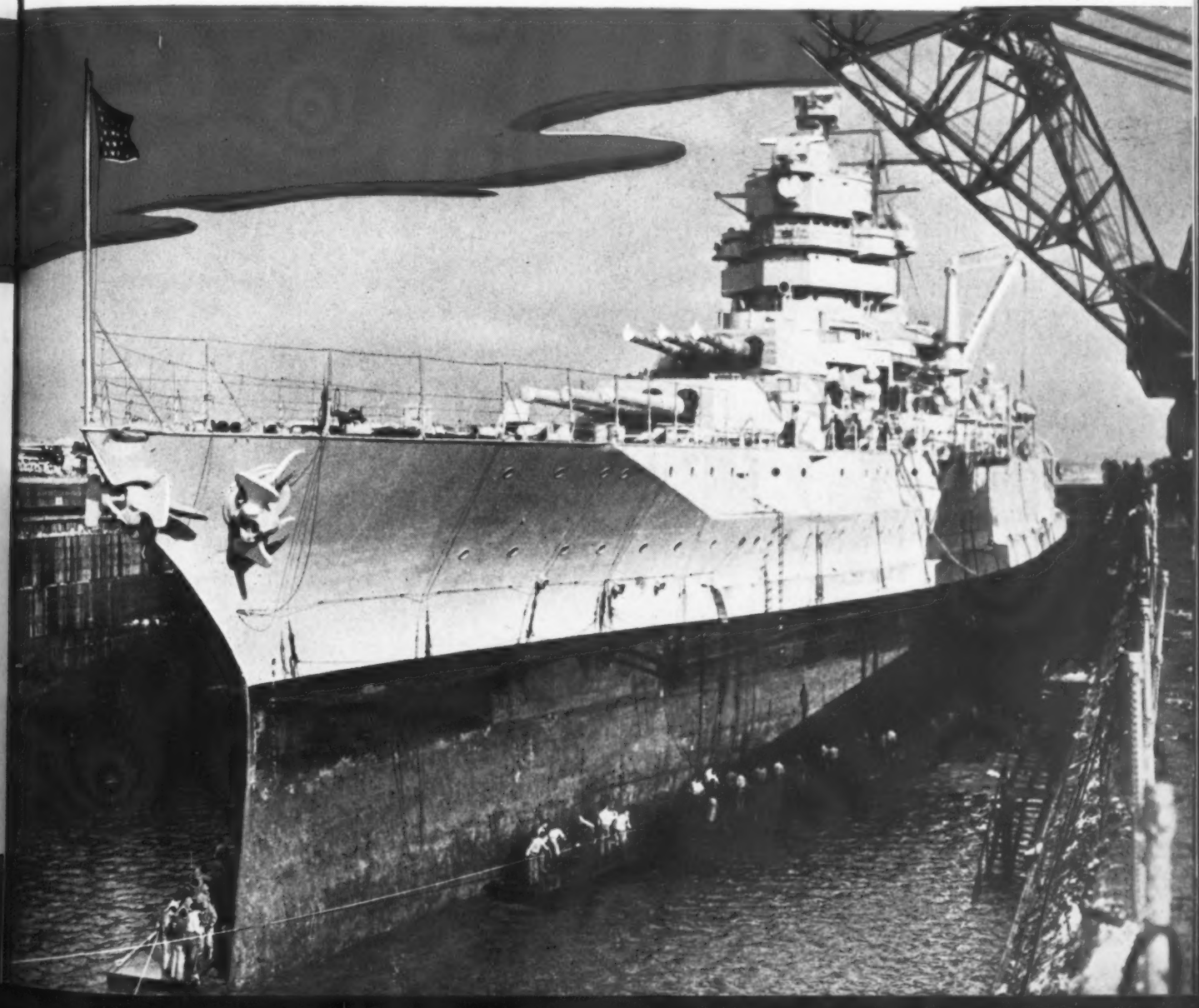
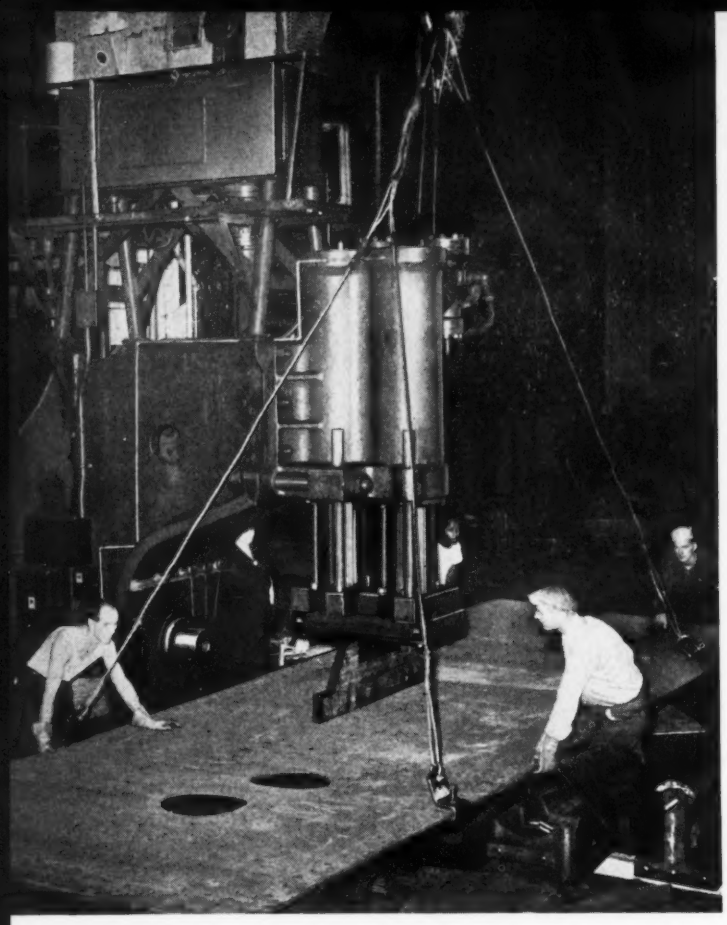




complete in itself with shops equipped with the latest types of machines.

Among the modern types of machines that help fabricate the steel plate for destroyer escort vessels is the Southwark hydraulic press seen in Fig. 1. This press is shown being used for straightening a large steel plate of a transport that was damaged by fire. A total of 325 tons pressure can be exerted by the two vertical rams in operations of this sort or in bending work. In addition, there is a horizontal ram that is sometimes applied in bending flanges on steel plates, in securely holding work that is being operated upon by the vertical rams, and so on.

Operations on bending slabs has been made easier by the use of small self-contained Watson-Stillman bending units such as illustrated in Fig. 3. These units are made with a hydraulic ram on which a pressure up to 24.9 tons can be developed for bending I-beams and other shapes to the outline of steel templets. Heavy shapes are heated before bending, but some light shapes are bent cold. The application of these hydraulic units has speeded up shape bending greatly.

In an operation, the work-piece is held to the bending slabs by means of clamps as shown, but a helper with a heavy hammer must keep striking the clamps to prevent the shape from rising due to the force being exerted by the hydraulic ram. A second helper applies a "weeze bar" to prevent the shape from springing back after the ram pressure is released, until the shape has cooled sufficiently to retain its bent outline.

Heretofore, it was the practice to plane the edges of steel plates at angles to prepare them for electrode deposit in arc-welding operations. Now both sides of the plates are beveled simultaneously through the use of two-torch Airco Radiagraph oxy-acetylene machines. A typical operation of this sort is shown in Fig. 2. This method of preparing plate edges for welding has greatly expedited production.

Typical operations in the new machine shop, which is operated mainly as a jobbing shop on

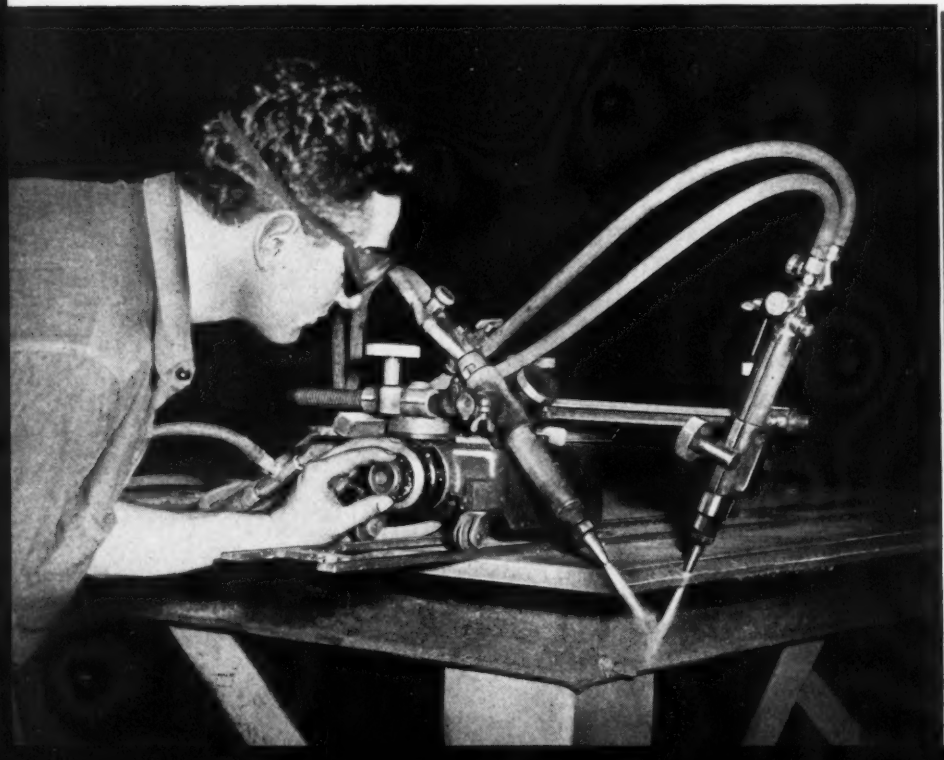


Fig. 1. (Above Left) Applying a Large Hydraulic Press for Straightening a Badly Warped Plate from a Transport that had been Damaged by Fire

Fig. 2. (Left) Steel Plates are Beveled on Both Sides by Two-torch Oxy-acetylene Machines to Prepare Them for Welding

repair work, will be described in the following. Fig. 6 shows a bending fixture devised for straightening long shafts. The fixture consists essentially of a long bed on which three rests are mounted for supporting the work. Shafts up to 75 feet in length can be handled.

The method followed is to clamp the bent shaft to one of the rests in the manner shown, and then heat the shaft at the point where it is to be straightened by means of an electrical heating coil that is slipped around the shaft. This heating coil is wrapped with asbestos. When the shaft has been heated to approximately 1450 degrees F., it is straightened by pulling up the bent end with a crane. A dynamometer applied between the shaft and the crane indicates the force that is being applied by the crane and the distance that the shaft is bent in steps of the straightening operation. The illustration shows a propeller shaft 15 inches in diameter by approximately 40 feet long being handled. It was bent about 5 feet out of alignment.

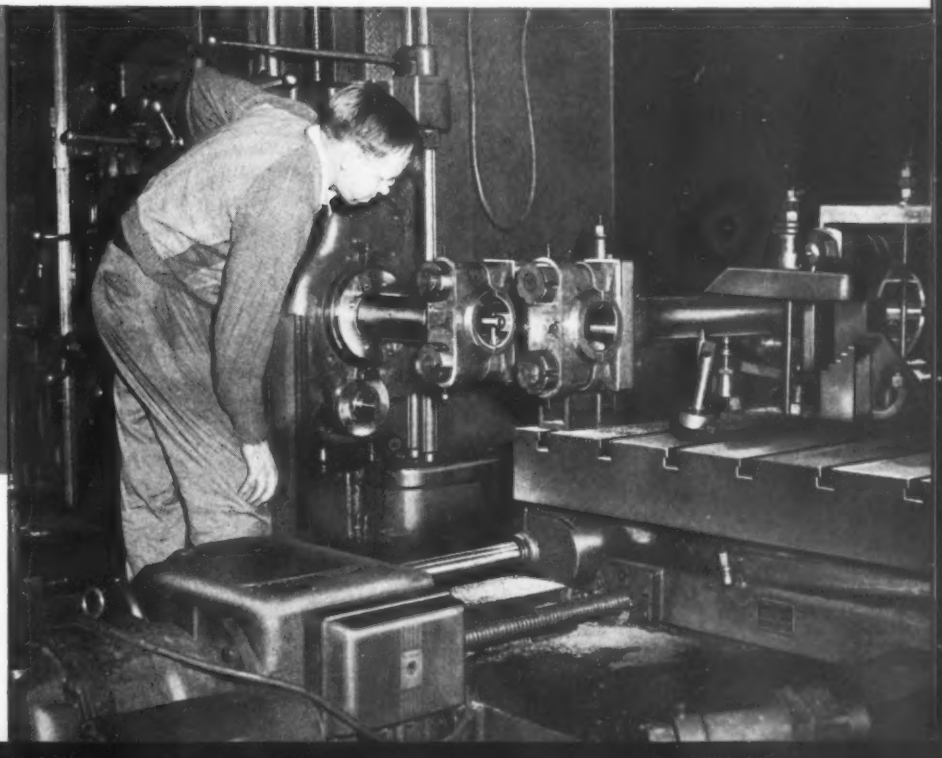
A typical operation on a Sellers horizontal boring, drilling, and milling machine is shown in Fig. 4. It consists of line-boring the crankpin and cross-head bearings of a connecting-rod for the main engine of a Coast Guard cutter. The two bearings in the cross-head are of bronze and are machined to a nominal diameter of 6 inches. The bearing in the crankpin end is finished to a diameter of 10 inches. The faces of all three bearings are finished in the same set-up.

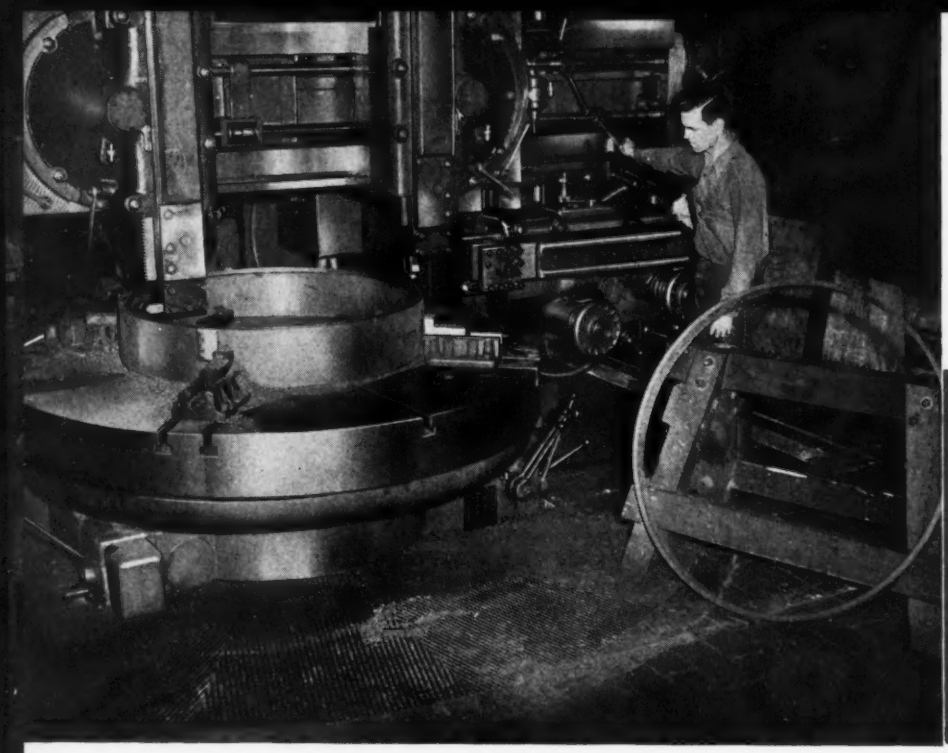
The application of a Cincinnati Hypro vertical boring mill for cutting piston-rings from large iron castings for the cylinders of vertical reciprocating steam engines is shown in Fig. 5. The practice is to cut a number of rings from one of these castings, a finished ring being seen at the right leaning against a wooden horse. The casting is 53 inches in outside diameter, and the machine has a swing of 96 inches.

In an operation, the casting is first counterbored to an inside diameter corresponding to that of the piston groove in which the ring will

Fig. 3. (Above Right) I-beams and Other Shapes are Readily Bent to the Outline of Templets by the Application of Hydraulic Ram Units

Fig. 4. (Right) Line-boring the Crankpin and Cross-head Bearings of a Connecting-rod for a Coast Guard Cutter Engine





BOSTON NAVY YARD

Fig. 5. (Left) Turning Piston-rings for a Vertical Reciprocating Steam Engine from One Casting on a Vertical Boring Mill

Fig. 6. (Below) Bending Fixture Devised to Facilitate Straightening of Long Propeller Shafts

be fitted by a tool on one of the rail-heads. Then a tool on the second rail-head is employed to turn the outside of the casting to approximately the cylinder diameter, which is 48 inches. The side-head is next used to cut off the ring from the casting to the desired width.

After the piston-ring has been split at one point on a milling machine, the operator of the boring mill files the split ends to a high degree of smoothness, so as to make them steam-tight when a bronze "keeper" is inserted in the slot.

A typical operation on an Axelson engine lathe is illustrated in Fig. 7. This consists of cutting an Acme thread for a length of 37 1/2 inches on a brass rod of 3/4 inch diameter. The threads are cut 2 1/4 per inch. The lead of this thread over the entire length must not have an error exceeding 0.005 inch. Approximately fifteen cuts are taken in cutting one of these threads. The finished screw is used as a valve stem for the operating gear of vent type blowers. It is of left-hand type.

During normal times, the various Navy Yards are assigned certain work which becomes a specialty of those yards, and which they supply to all other yards. One of the specialties of the Boston Navy Yard is chain for use aboard ship, particularly Di-Lok anchor chain. This yard is also noted for its manufacture of rope. The production of chain is carried out in the well equipped forge shop of the main yard. Typical operations in producing Di-Lok anchor chain from 3 3/8-inch diameter bar stock will now be described.

Each link of Di-Lok chain is made up of U-shaped male and female members. The arms

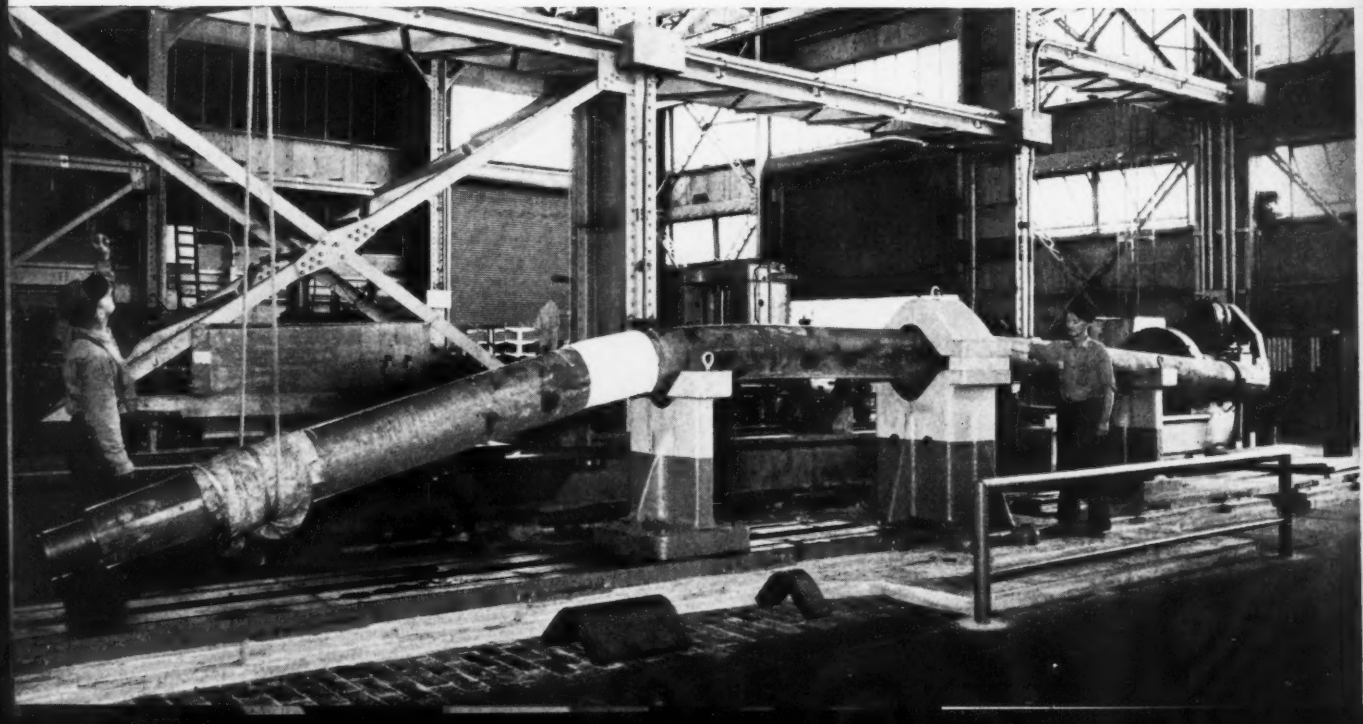
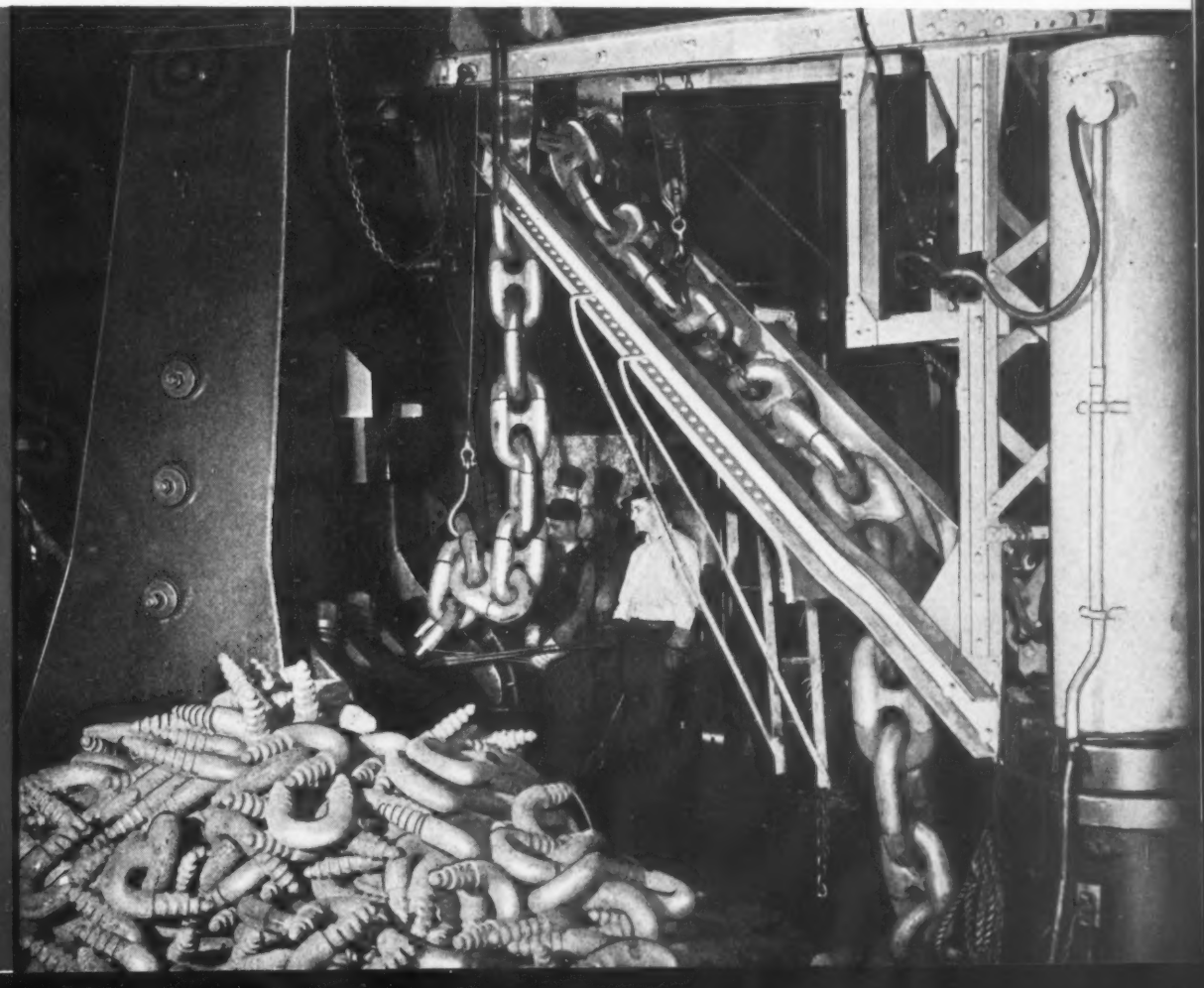


Fig. 7. (Right) Cutting a Thread 37 1/2 Inches Long on a Valve Stem within a Cumulative Error of 0.005 Inch

Fig. 8. (Below) Drop-hammer and Crane Assembling Di-Lok Chain into 90-foot Lengths

of the male member are tapered and have four solid rings forged on them, as seen from the examples in the foreground of Fig. 8. The arms of the female member have sockets forged in them to receive the male projections. When the two members have been assembled together, the sockets of the female member are pressed on the male projections under a heavy drop-hammer and securely locked to them, thus producing what is, in effect, a solid link.

The first operation on these chain links consists of heating round bars of stock to forging temperature in a rotary-hearth, oil-fired furnace. When taken from this furnace by tongs, the bars of stock have attained a temperature of 2000 degrees F. They are immediately transferred to a Bliss hydraulic press such as shown in Fig. 9, and laid across the rollers of a fixture mounted on the press platen. Attached to the ram is a long punch. When this punch descends,



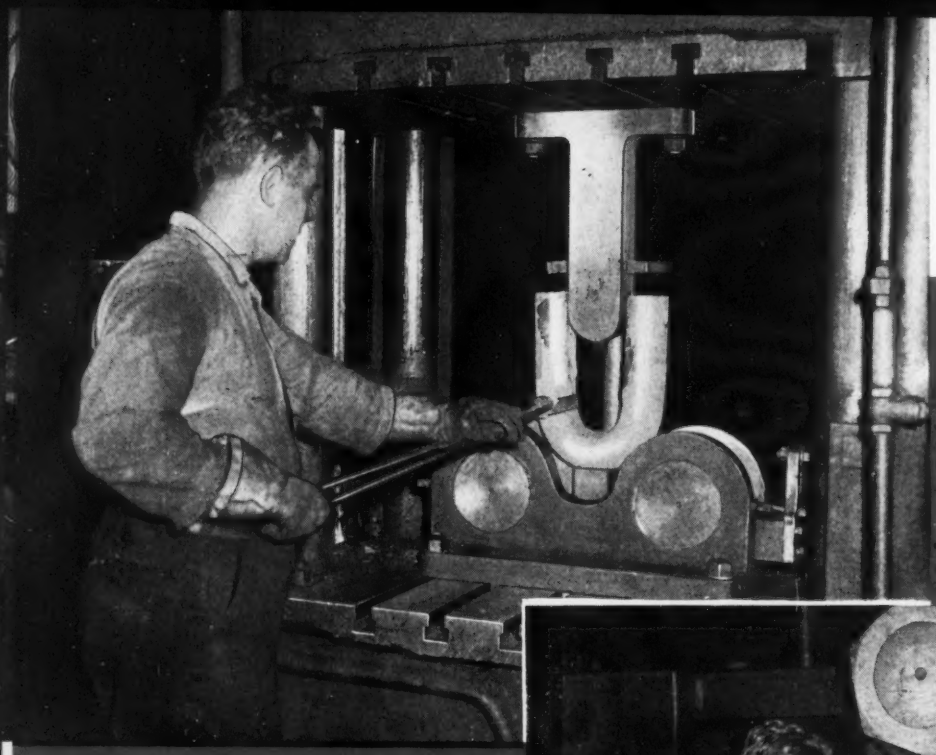


Fig. 9. (Left) Straight Bars are Bent into a U-shape in Making Chain Links by Forcing Them down between Rollers of a Die-fixture on a Hydraulic Press

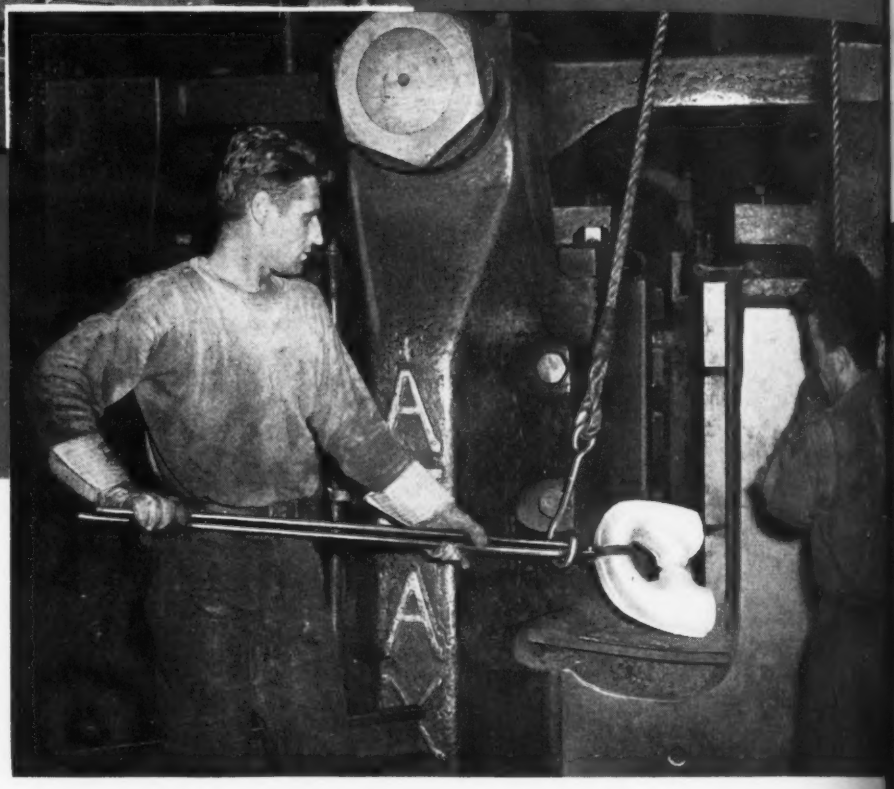


Fig. 10. (Right) Sockets are Forged in the Two Ends of the Female Link Member on a 6-inch Forging Machine

it exerts pressure on the middle of the bar and pushes it down between the fixture rollers to form a U-shaped piece. When the press ram ascends, an ejector in the bed of the press raises the work, as shown in the illustration, to permit the U-shaped piece to be easily removed by the operator.

From this preliminary bending operation, the bars are transferred to a forge furnace and heated to 2200 degrees F. Male members are then forged complete under drop-hammers fitted with multiple-impression dies in which the metal in the projections is drawn out to the required taper and then upset into a series of solid rings. There is, of course, a separate production line for the male half links and the female half links

When the U-shaped pieces that are to be formed into female link members have been brought up to forging temperature, they are transferred to the Ajax 6-inch forging machine shown in Fig. 10. Here both ends are upset simultaneously and a socket hole formed in each end. The forging machine is equipped with two-impression die-halves. Both sockets on a piece are formed in the upper impressions and finish-forged in the bottom impressions.

After this upsetting operation, the female parts are reheated in a furnace and then brought to the Erie 10,000-pound drop-hammer illustrated in Fig. 11, where they are assembled to male members to form long lengths of chain. Fig. 11 shows a view from the front of the press, which

is also illustrated in Fig. 8. In this link assembly operation, a male member is slipped through the previously assembled link on the chain and then the hammer man pushes a heated female member firmly over the male projections, as shown in Fig. 11. The assembled link halves are then seated in the impression in the drop-hammer die, after which the hammer is operated four or five times to forge them solidly together.

As the chain links are assembled, they are pulled up over the boom of the jib crane seen in Fig. 8. This crane is used to transfer the newly assembled links to the Chambersburg trimming press illustrated in Fig. 12, and then back again to the drop-hammer for assembling the succeeding link. In the trimming operation, the still hot female link member is laid in a die and is pushed through this die by the descending punch. The flash is cut from the outside of the link by the shearing edge of the die and from the inside by a projection on the punch that extends downward into the link.

This heavy chain is customarily forged in lengths of 15 fathoms (or 90 feet). Each "shot" of that length weighs approximately 5 tons.

The operations described are, of course, only a few of the thousands performed in the Boston Navy Yard, but they typify the engineering thought and shop experience that prepare our ships today for winning tomorrow's battles.

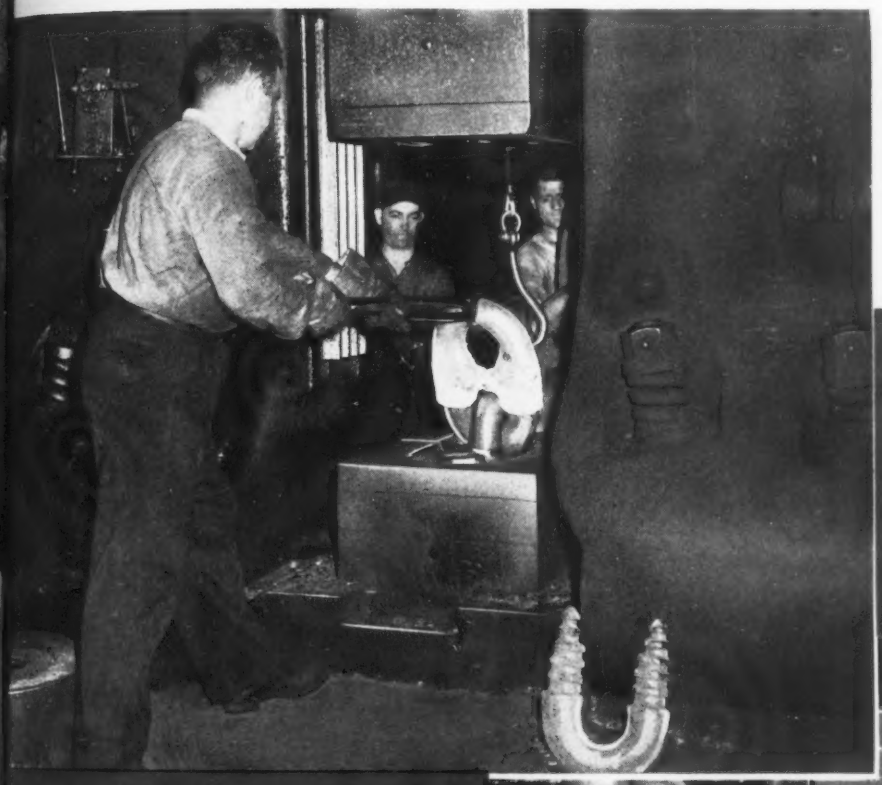


Fig. 11. (Left) Placing a Female Link Member over a Male Member prior to Forging the Two Solidly together

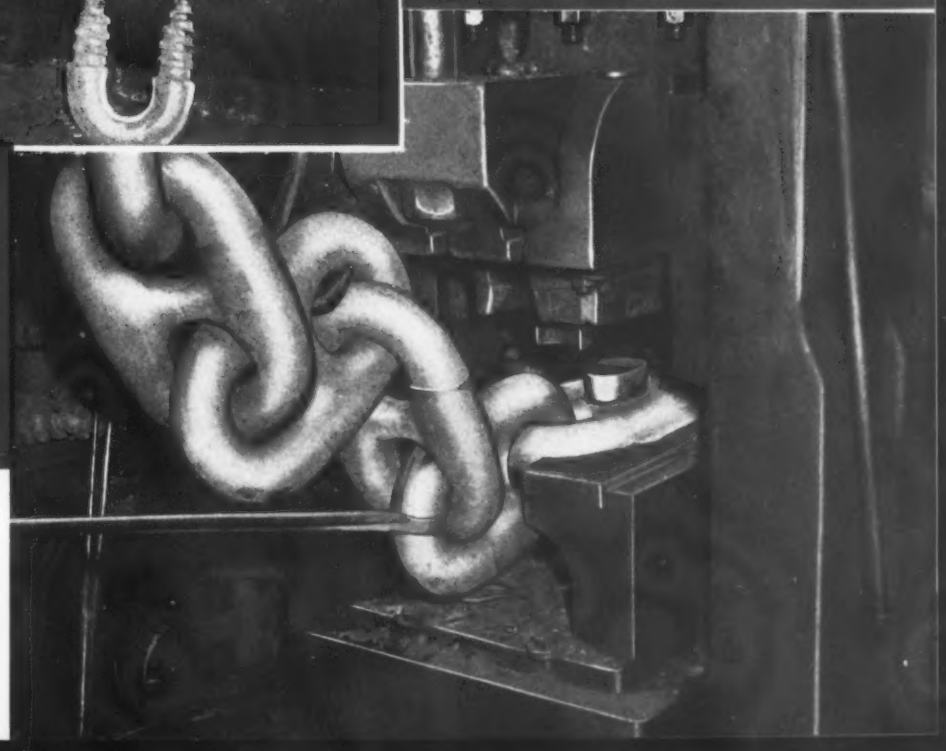
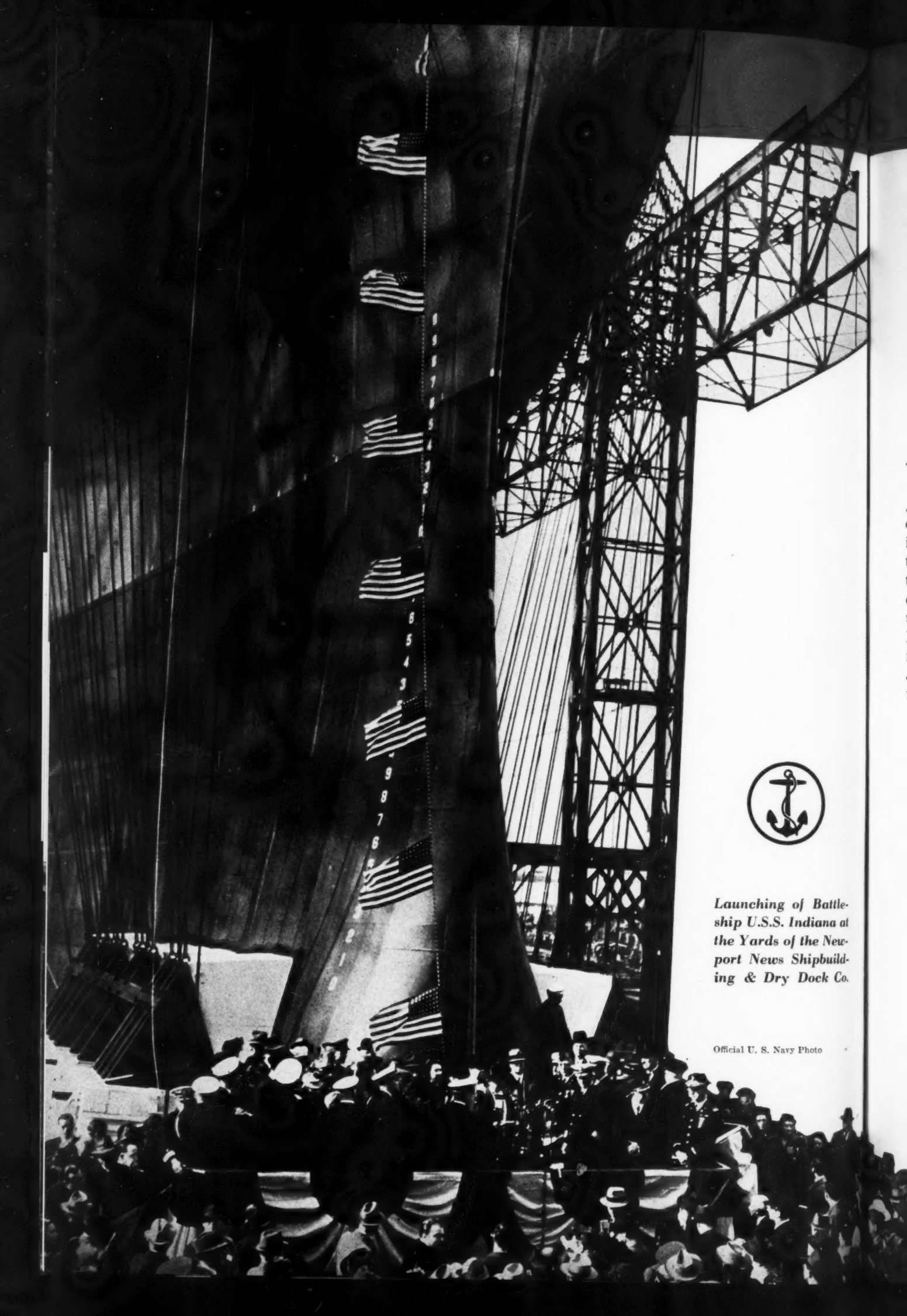


Fig. 12. (Right) Close-up View of the Trimming Operation Performed on the Di-Lok Chain Links Immediately after They are Assembled



Launching of Battleship U.S.S. Indiana at the Yards of the Newport News Shipbuilding & Dry Dock Co.

Official U. S. Navy Photo

NEWPORT NEWS

Builds Famous Men-of-War

By HOLBROOK L. HORTON

EVER since 1897 the Newport News Shipbuilding & Dry Dock Co. has been building ships for the Navy. The roll of men-of-war completed at this yard, one of the largest in the country, includes such famous names as the *Pennsylvania*, flagship of the Pacific Fleet; the *Maryland* and the *West Virginia* damaged during the Japanese attack at Pearl Harbor; the *Yorktown* lost after the glorious Battle of Midway; the *Boise* which earned undying fame in an engagement at Guadalcanal in which six Japanese warships were sunk; the *Hornet* which fought valiantly and was lost during the Battle of Santa Cruz Islands; the *Enterprise*, the *Essex*, the *Indiana*, the new *Yorktown*, and the new *Hornet*.

One of the distinguishing features of shipyards, particularly those where large naval vessels are being built, is the huge size of the units that have to be constructed and lifted into place aboard ship. A striking example of this is the large Babcock & Wilcox boiler shown in Fig. 1 which is about to be hoisted into place on a newly constructed vessel.

Even more dramatic is the huge 350-ton gantry crane designed by the Newport News Ship-

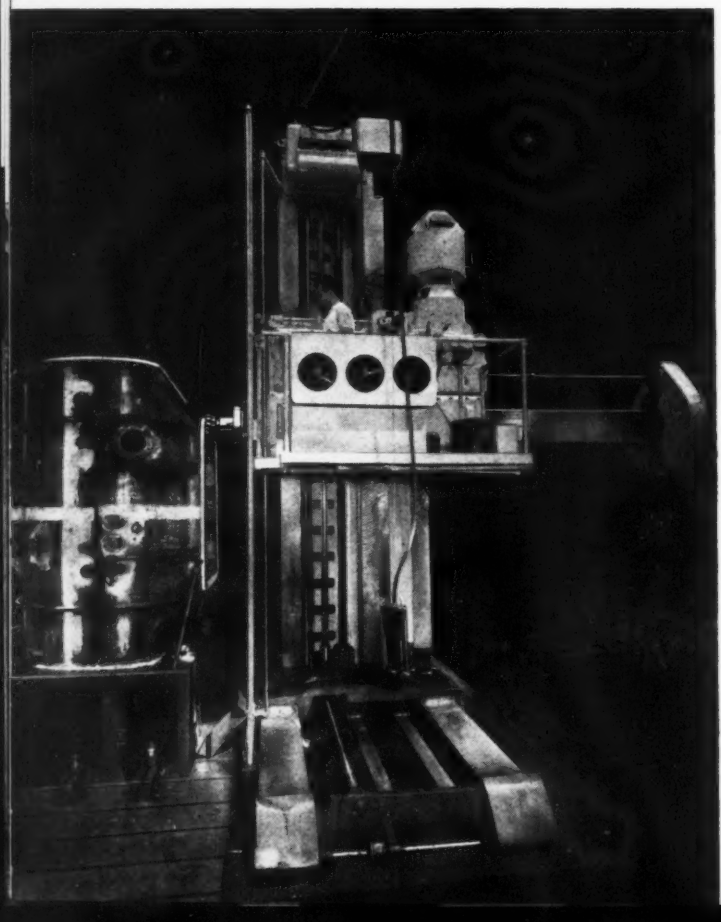
Figure 1

Fig. 2. (Left) This 350-ton Gantry Crane is Replacing the Roof of a Special Machine Shop after a Large Piece of Equipment has been Lowered into Place for Machining

Fig. 3. (Below) Facing Flanges of a Condenser Shell on a Large Milling, Planing, Facing, and Boring Machine

building & Dry Dock Co. and built by Shepard-Niles and the American Bridge Co., which is shown in Fig. 2 moving the roof of a special machine shop back into position after a large piece of heavy equipment has been lowered into the shop for machining. This crane and arrangement for roof removal have been particularly useful in handling the largest size gun turrets.

An interesting feature of this crane design is the crossing arrangement of the crane tracks with the railroad tracks, which permits freight cars to be brought directly under the crane for unloading. At this crossing, the ends of the crane rails are curved downward, so that the support of the crane wheels is transferred to a flat steel plate which extends across the break in the rails. Each wheel rolls over this plate on exceptionally heavy double flanges which are strong enough to support the crane when fully loaded. With this arrangement, no shock or jar is imparted to the crane when it crosses the railroad track.



Before they are completed, however, many of the huge units needed in naval ship construction must pass through machine and fabricating shops where special set-ups and tooling are the rule rather than the exception. Fig. 4 shows the turning of the track of a large gun turret. The entire turret, complete with guns and auxiliary equipment and weighing over 250,000 pounds, is mounted over the table of a Sellers 35-foot boring mill. The boring mill table is surrounded by a large supporting platform which is at the same level as the table surface. The cross-rail and boring heads of the machine have been removed, and the normal positions of work and tools are reversed, due to the size and weight of the turret. Thus the turret is supported in a fixed position on a special platform, while the cutting tools are mounted on the rotating table and are carried around the work.

Before bringing the turret into position, a large circular mandrel is fixed on the table in a concentric position, and four locating blocks are placed at evenly spaced points around the table. These are adjusted to within 0.001 inch of a

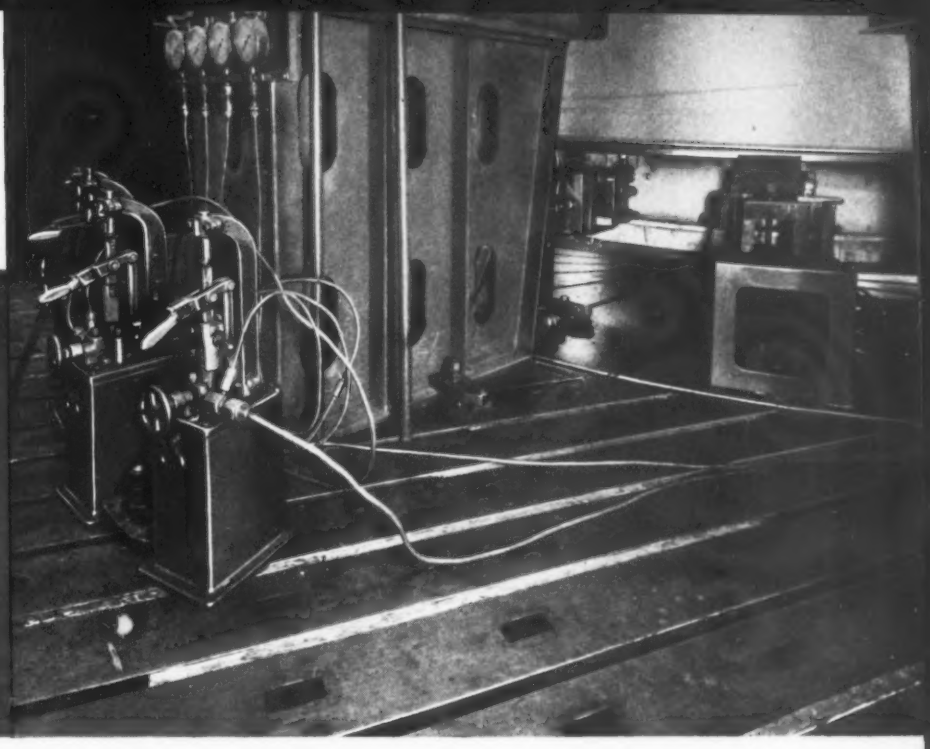


Fig. 4. Unusual Set-up for Machining a Gun Turret Track. Controls at Left are for Hydraulic Jacks which Hold Turret in Fixed Position over Boring Mill Table. Tool that is Cutting Under Side of Track is Shown being Carried around Turret on Revolving Table

concentric position with respect to the mandrel. The mandrel is then removed and the turret is lowered into position on four hydraulic jacks, one of which is shown in the illustration. The locating blocks are now used as reference points for positioning the turret track so that it is concentric with the table. Another set of blocks provides reference points for measuring the depth of cut taken around the outside of the track. The individually operated jacks permit the turret to be raised to the proper height for the turning operation and to be leveled within very close limits.

Two tool supports are located diametrically opposite each other on the boring mill table and are traversed around the turret to take three cuts—one on the outside, one on the inside, and one underneath. High-speed steel tools are used for roughing and carbide-tipped tools for semi-finishing and finishing this track, which is made of high-nickel-content steel.

The boring mill employed for this operation was originally designed and used for machining the turbines installed in the famous Dnieprope-trovsk Dam on the Dnieper River in Russia.

Another operation on a large work-piece is shown in Fig. 3, where the flanges of a condenser shell are being faced on a Morton milling, planing, facing, and boring machine. This operation was previously performed on a planer, but difficulty was encountered in holding the work rigidly. With the arrangement illustrated, the condenser shell can be securely mounted and braced on a floor plate. The use of this machine has cut down the time required for machining this piece by about 30 per cent. The machine has also proved to be most effective for cutting key-ways in propellers and rudders and for boring the rudder.

Propulsion turbines of various sizes are built for the Navy's ships at the Newport News yards. In fact, it may be mentioned that this company received special commendation from the Navy for the splendid performance of four turbines which brought the U.S.S. *Boise* safely home on a journey of 10,000 miles after it had been severely damaged in engaging six Japanese warships.

In Fig. 5, a rotor for a low-pressure turbine intended for cruiser installation is being turned on a 120-inch Niles lathe. The workman is shown testing the width of one of the blade grooves. In the operation, a special forming tool is used to cut serrations on each side of the grooves to hold the turbine blades firmly in place. The rotor is about 4 feet in diameter and 15 feet long.

A completed turbine rotor is shown in Fig. 7 mounted on a Gisholt balancing machine. The control of this machine is entirely electrical. Both ends of the turbine rotor are supported by half bearings, in which are inserted the same bearing surfaces used to support the work in its final assembly. The two bearings are integral with light aluminum supporting structures, which are suspended from wires. As the work is rotated, any unbalance in the rotor causes vibration in the suspended bearing structures, which, in turn, is transmitted by the supporting wires to powerful electromagnetic pick-ups.

The turbine rotor is tested while being rotated

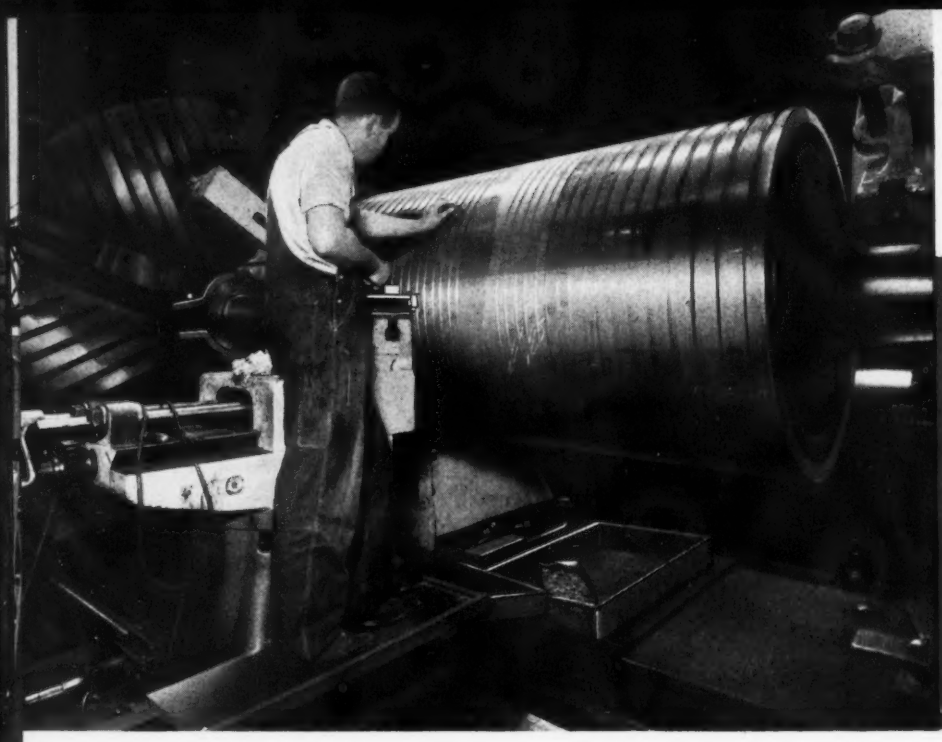


Fig. 5. (Left) Gaging the Width of Blade Grooves on a Turbine Rotor. A Forming Tool is Used to Cut Serrations on Either Side of the Grooves to Hold the Blade Securely in Place

Fig. 6. (Below) Because of the Variety in Size of Worm-gears Called for, a Fly Cutter is Usually Made up for Each Job

by an electric motor. A filter system keeps out vibrations that occur more than once per revolution of the rotor, so that the meters will respond only to electrical impulses due to unbalance in the rotor. Direct readings for unbalance of both ends of the rotor can be taken in a single run after adjustments of the various dials on the indicating panel annul the vibrations recorded. The illustration shows the operator inserting a balancing weight around the edge of the turbine rotor at the proper angular position.

Much of the work done in a shipyard is what might be called "job shop" work, consisting of small quantities of a large variety of pieces of different sizes. Thus ships of many nations are brought to Newport News for repair and to take one part, as an example, worm-gears of a different size and pitch are required for almost every ship. Since only one or two gears of a particular size and pitch are usually required, it is more economical to make up a fly cutter to suit the requirements of each than it is to keep available a wide range of gear-cutting hobs.

In Fig. 6, a worm-gear to be used in the steering mechanism of an aircraft carrier is being cut with a fly cutter mounted in a special tangential head on a Gould & Eberhardt 48-inch gear-hobbing machine. Although this method takes longer than cutting the gears with a straight hob, it has the advantage of being quicker when a special hob is not available. This machine is also used with the regular head for hobbing helical and spur gears of a wide variety of sizes and pitches.

A striking illustration of the wide range of sizes of work handled in the Newport News shipyard is shown in Fig. 8. Both the small nut on top of the boring-bar and the large nut that the boring-bar is cutting have been threaded in the same shop. The large nut is a luffing screw nut for a 25-ton Dravo crane, and has a 2 1/8-

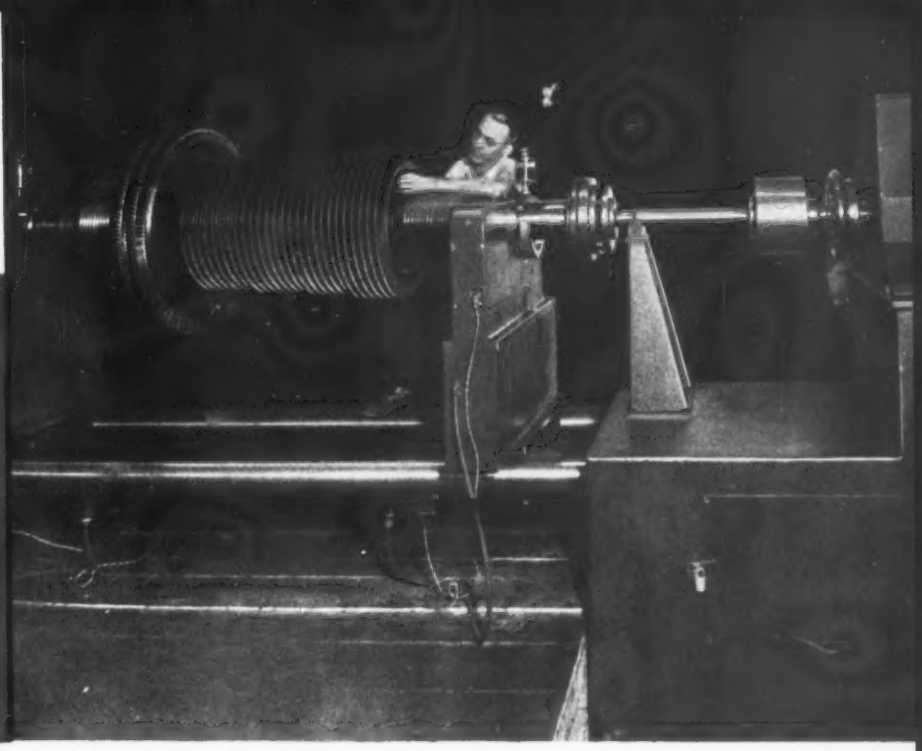


Fig. 7. (Right) Balancing a Completed Turbine Rotor on an Electrical Balancing Machine

Fig. 8. (Below) Cutting a Buttress Thread in a Bronze Luffing Nut for a Crane. Also Machined in the Same Shop is the Small Nut Seen on the Boring-bar. This Indicates the Wide Range of Jobs Handled

inch pitch and a single thread of the buttress type. The initial bore of this nut is 8 3/4 inches in diameter.

The operation is being performed on an American 48-inch lathe with a boring-bar 5 inches square and 10 feet long, which is supported at the outer end by a stationary guide through which it travels as it is fed into the nut. The travel of the bar into the nut is about 3 feet. A 1/16-inch cut at 14 to 20 R.P.M. is taken for roughing, and a 1/4-inch cut at 7 R.P.M. for finishing. This nut has an allowable backlash of from 0.20 to 0.030 inch.

Another interesting operation is shown in Fig. 9, in which the bearing strip slots of the stern tube and strut bushing for a main propeller shaft are being rough- and finish-planed. The tool shown in the cutting position is used for roughing out the bottom of each slot. After it reaches the end of a stroke, it is fed laterally across the tool-holder for the next stroke, producing a flat surface. After the finish cut is taken, the tool-holder is revolved to bring the two tools shown in the small holding blocks at the top into the cutting position. Each of these tools is set at an angle so that when fed down into a slot, they cut both sides simultaneously to form a dovetail which holds the rubber-faced bronze bearing strip securely. For cutting each slot, the entire tool-holder is indexed around the fan-shaped holding plate to the proper mark for each slot location.

In Fig. 10 is shown a special arrangement for feeding bar stock through the collet chucks of two Gisholt turret lathes. This was developed by workmen in the shop, and has proved so satisfactory that it is now in use on all similar types of lathes in the yard. The bar stock rests in a tubular support which is slotted at the bottom to allow scale and rust to fall through and at the top to permit the inward travel of a fol-

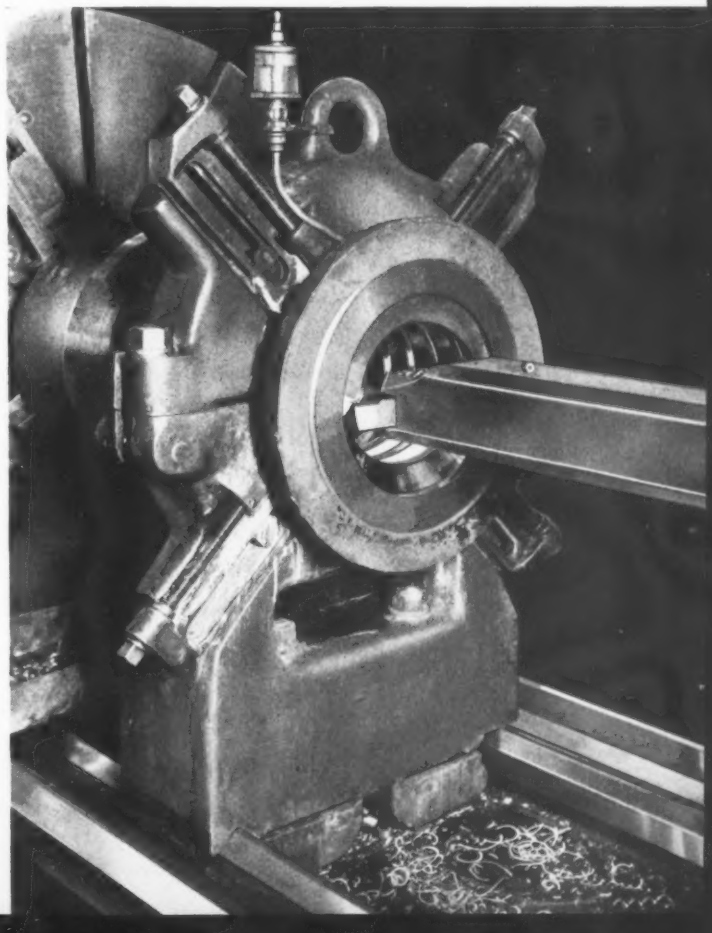


Fig. 9. (Left) Planing Bearing Strip Grooves in a Stern Tube and Strut Bushing. Tool in Cutting Position is Roughing out the Bottom of Groove. Two Tools at Top of Holder are Swung down to Cut Sides of Groove

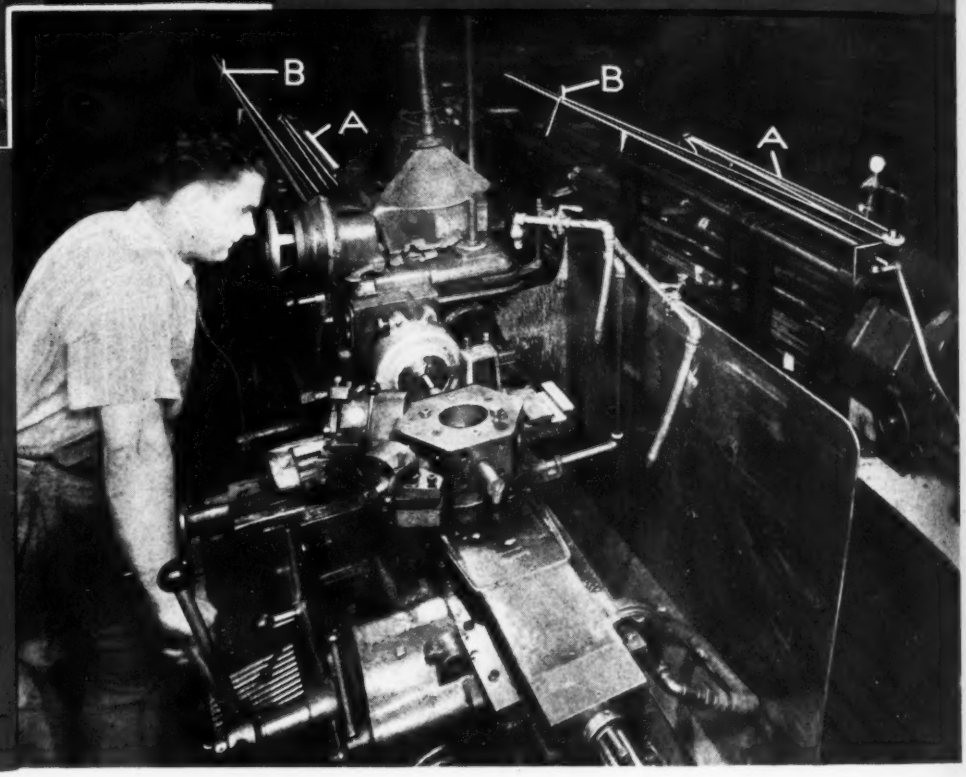


Fig. 10. (Right) Ingenious Arrangement Used for Feeding Bar Stock through a Collet Chuck. Pneumatic Cylinder A is Connected by Rope with Follow-up Plunger B Bearing against Outer End of Bar Stock. When Collet Chuck is Opened, Bar is Automatically Fed Inward to Work-stop

low-up plunger which bears against the outer end of the bar. This plunger is connected by a cord over a series of pulleys with a pneumatic plunger which operates from the regular shop compressed-air system. A constant pressure is thus brought to bear on the bar and tends to force it through the collet chuck. This pressure is varied from 40 to 80 pounds per square inch, depending upon the size of the bar stock.

In use, a work-stop in the turret is brought into position, the collet chuck is released, and the bar is automatically fed forward until it strikes the stop. The collet is then clamped tightly around the bar and the turret is indexed for the successive machining operations. Due to the pulley arrangement, the pneumatic plunger travels only 4 feet for a 16-foot travel of the bar stock. In the illustration are shown tool-steel chisel blanks which are turned out in large quantities, as about a thousand are used in hand chipping operations in the yard each day.

Both thin-walled and standard pipe and tub-

Fig. 11. (Right) Forging a Large Propeller Shaft in a Steam-hydraulic Forging Press. The Chain Type of Belt is Driven by a Tumbling Block which Rotates the Massive Billet during the Forging Operation

Fig. 12. (Left) Cold-bending a Thin-walled 6-inch Pipe to a 90-degree Angle. The Two Mandrels Shown in the Foreground are Used Inside the Pipe. The One at the Left with a Toggle Head is Used in Thin-walled Pipe and the One at the Right in Standard Pipe

ing in sizes from 2 1/2 to 6 inches in diameter are bent in the Wallace pipe and tube bending machine shown in Fig. 12 to angles up to and including 90 degrees. The illustration shows a 6-inch thin-walled steel tube being bent cold to a 90-degree angle. In the left foreground, are shown two types of mandrels which are used inside the pipe to support it during bending. The one at the left, with the toggle arrangement, is used in bending thin-walled pipe, and the one at the right, pipe of standard thickness.

At the start of the operation, the mandrel is inserted in the pipe and held in place by a hydraulic plunger at about the point where the bend is to be made. The rotary jaw is then clamped tightly around the pipe, which is pulled through the fixed jaw or guide, over the mandrel, and around the quadrant-shaped groove until the proper angle is obtained. Women operators are employed in this yard to run this and many other heavy-duty machines.

The United Engineering 1200-ton steam-

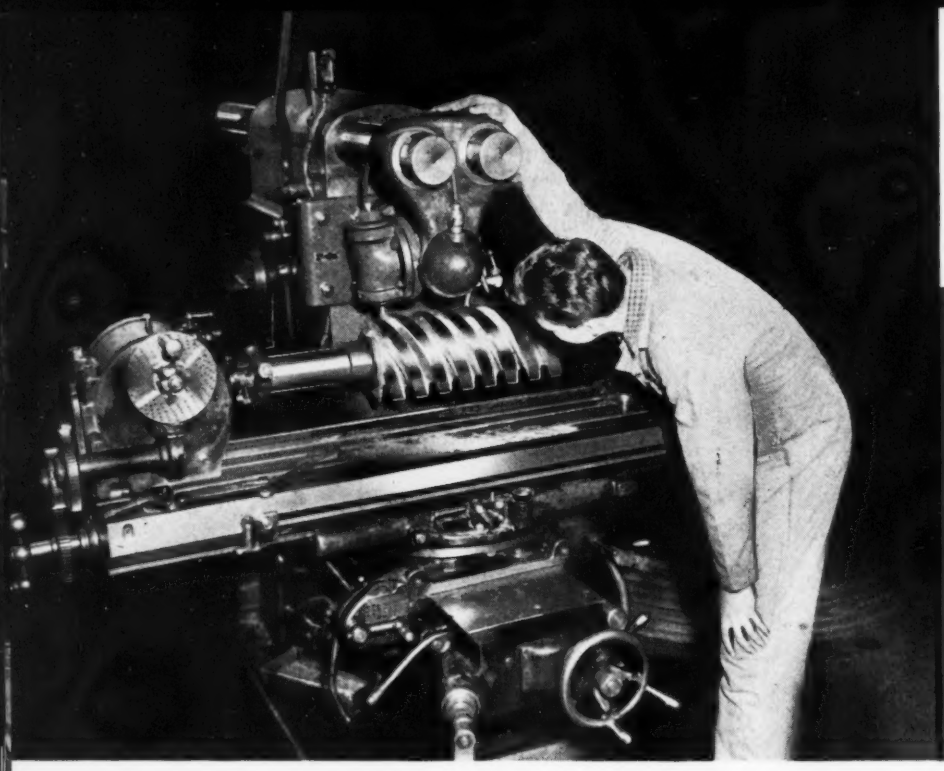


Fig. 13. An Apprentice Operating a Milling Machine to Cut the Thread of a Table Worm for a Large Open-side Planer. All Apprentices are Started Immediately on Production Work as Part of Their Training

hydraulic forging press shown in Fig. 11 is used for forging billets and ingots weighing up to 30 tons. Steam from the power house is supplied to an intensifier which has a steam cylinder on one end and a hydraulic cylinder on the other. This provides the greatly increased pressure needed for operating the press ram. The ingot shown in the illustration is being forged into a propeller shaft. An electrically operated tumbling block attached to the overhead crane hook rotates the heavy ingot during the performance of the forging operation.

One of the accomplishments other than the building of ships of which the Newport News Shipbuilding & Dry Dock Co. may be justly proud, is the training of its apprentices. For many years, this company has had an outstanding school in which a wide variety of trades are taught in the classroom and the shop.

An unusual feature of this school is that, except for welding, there is literally no practice work, the student being engaged in active production right from the start of his training. A check on the work done by apprentices in this yard on a given day showed that they were engaged in performing the following important jobs: Boring stern tubes on aircraft carriers; all shipwright work on a cruiser; installing anchor-handling gear, steering gear, boat cranes, etc., on a battleship; all kinds of fitter and mold loft work; operating all sizes of lathes, boring mills, and other machine tools engaged in regular shop

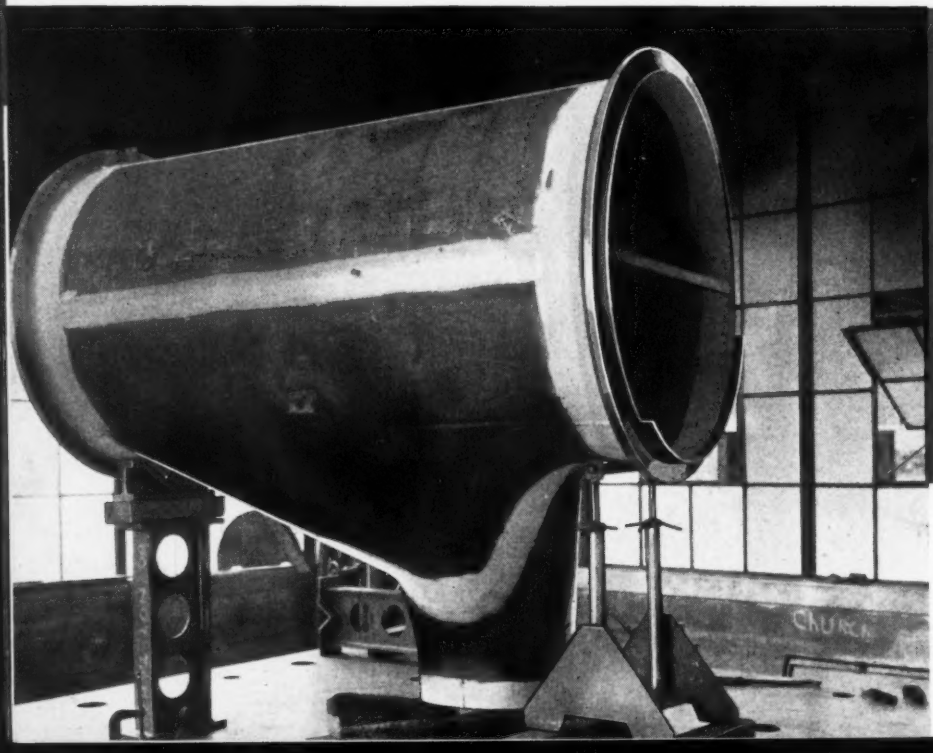


Fig. 14. A Condenser Shell Entirely Prefabricated by Welding, Using Six Pieces of Boiler Plate. Note Double Curvature of Pieces in Lower Section. These Curved Pieces Require Careful Preforming

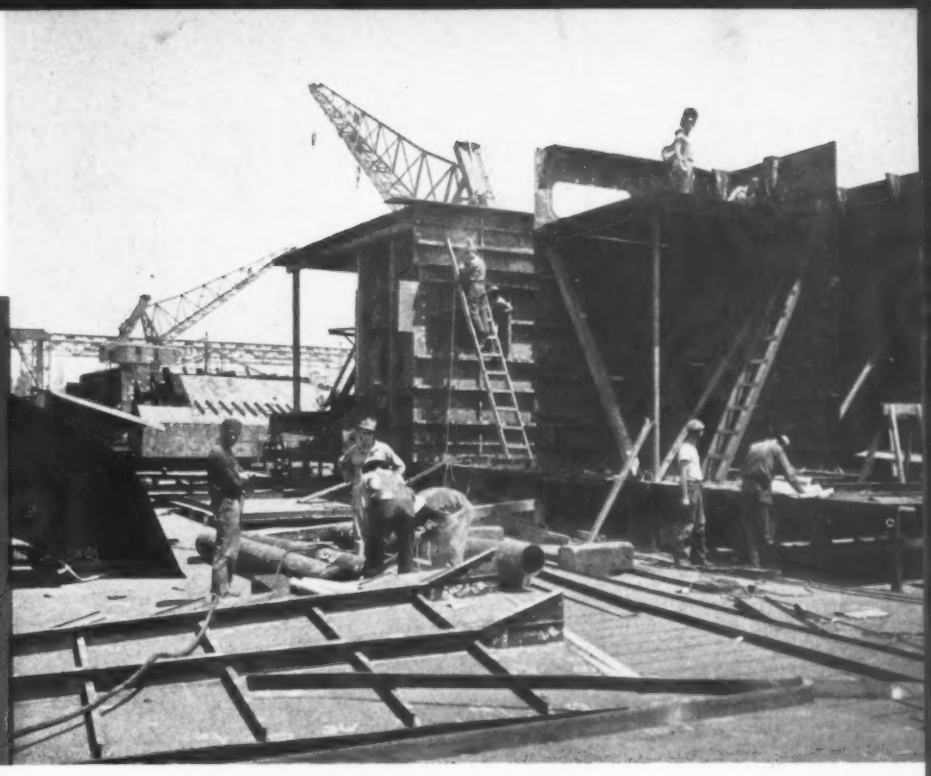


Fig. 15. Welding Bulkheads on a Special Sub-assembly Platform Located beside a Sunken Ship Basin. Completed Units can be Quickly Swung into Place aboard Ship by the Cranes Seen in the Background

production. None of these apprentices was functioning as a helper. In Fig. 13, an apprentice is shown milling a table worm for a large open-side planer.

At the Newport News yard, as in other shipyards throughout the country, welding is playing an increasingly important part in both the interior and exterior construction of naval ships. The training of welders is, therefore, being given special attention. The high rate of initial spoilage usually experienced makes it impractical to start welding trainees directly on the job, as is done in other branches of the training program. Special buildings have, therefore, been set aside for training welders, where this skill may be acquired by the successive mastery of increasingly difficult arc- and tack-welding exercises.

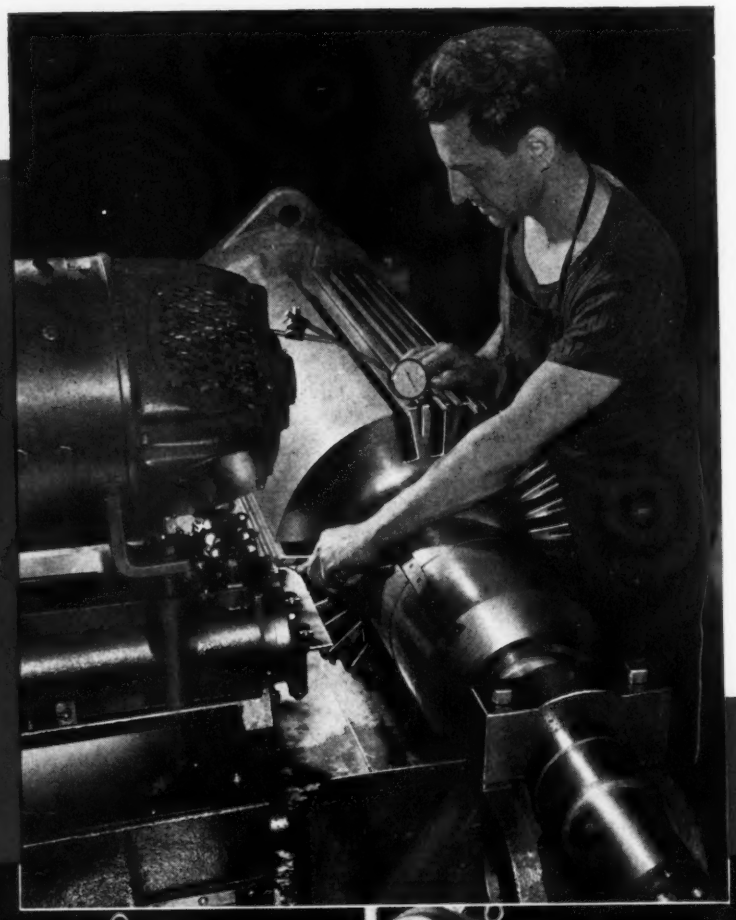
Designed specifically for welding instruction, rows of metal booths extend down the center of the building, with openings at top and bottom of each booth to permit the free flow of air. Resistors are located high in the ceiling, so that the heat can be more readily dissipated. A blower delivers fresh air into each booth near the bottom and fans exhaust heat and fumes through ventilators in the roof. Each booth is provided with a switchboard so that the student can adjust current values to the requirements of his exercise. There are 100 booths in one building which can be occupied twenty-four hours a day. Under these ideal conditions, the output of trained welders has been truly amazing.

An example of the extent to which castings are being replaced by weldments is the large condenser shell shown in Fig. 14, which has been entirely prefabricated by welding. Six pieces of 5/16-inch special boiler-plate steel were used in making this unit. This method of fabrication was found to be quite satisfactory in this case, even though the pieces for the lower part of the weldment required preforming to a somewhat complex curvature.

The outdoor construction of sub-assembly units is shown in Fig. 15. Here several large bulkhead sections are being welded on a special platform adjoining a sunken basin in which a ship is being built. The completed units can be hoisted into place with minimum crane travel.

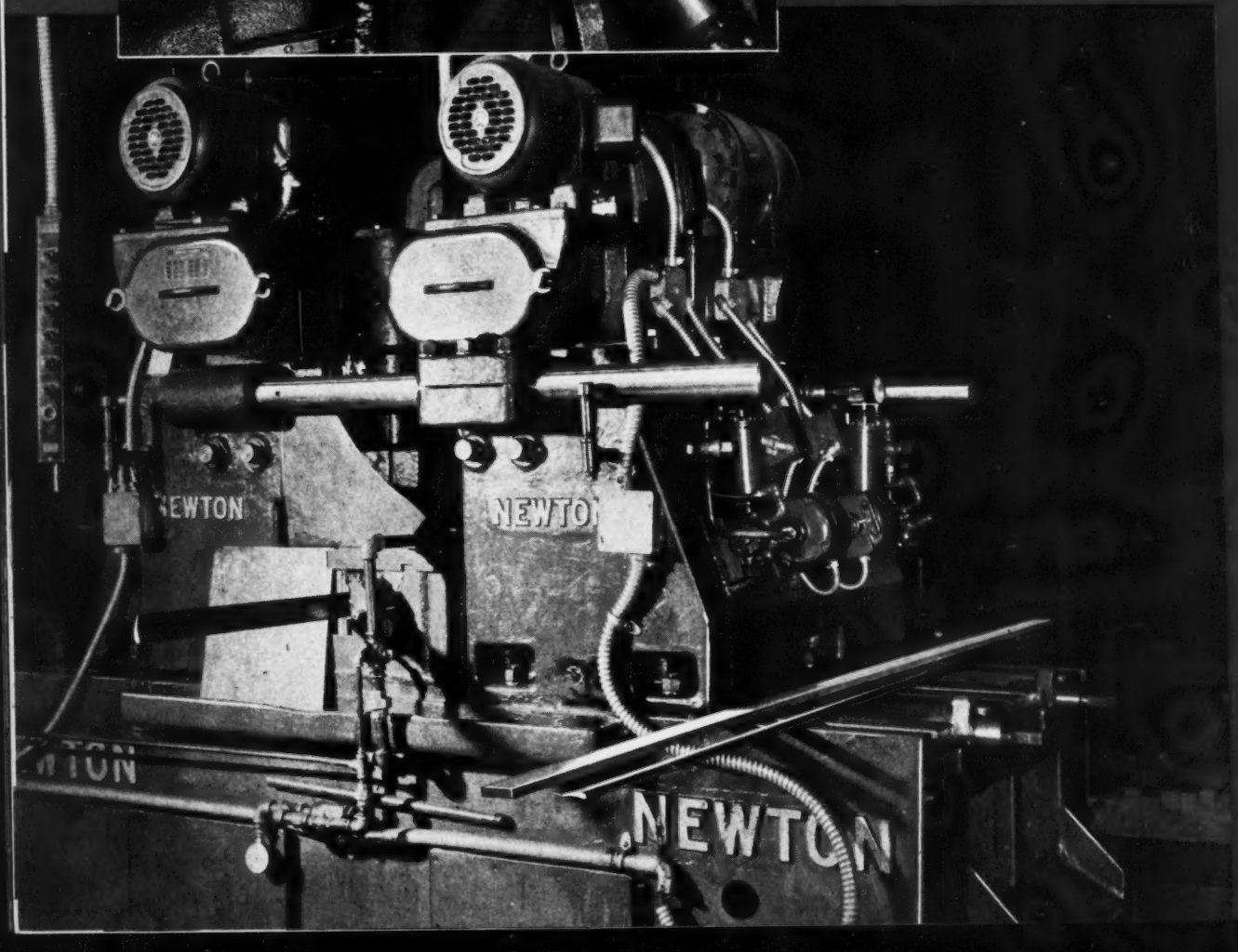
GENERAL ELECTRIC BUILDS

For the



(Left) A Specially Designed Thyratron-controlled Milling Machine Cuts Peripheral Wedge Slots in Generator Rotor. Three Cutters are Used Successively. Workman is Shown Positioning the Cutters

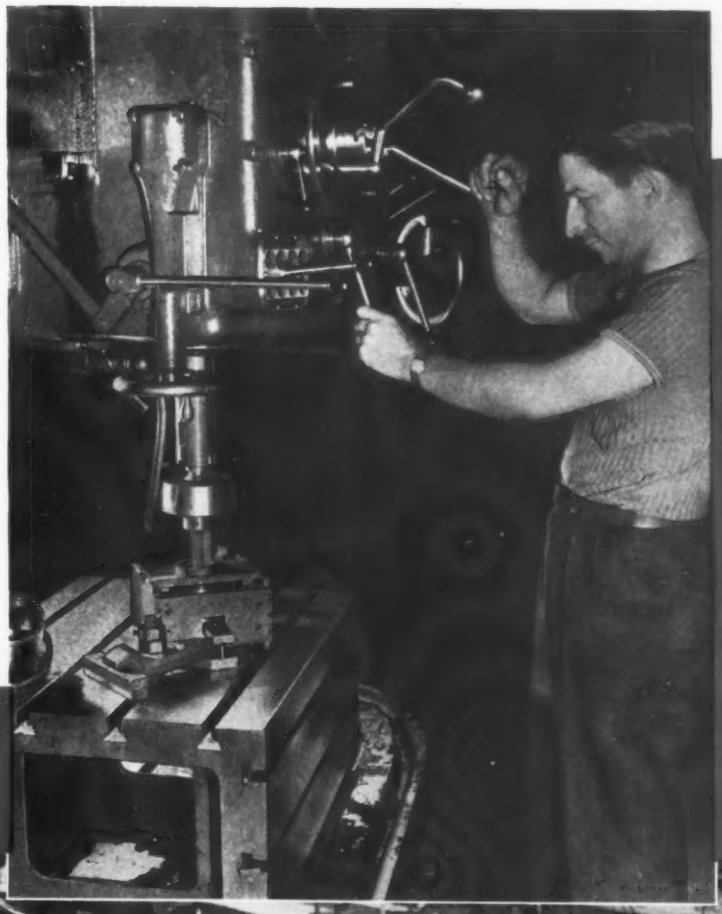
(Below) Four-spindle Milling Machine Designed to Turn out Diaphragm Blade Stock from Solid Bars. Original Bar and Finished Blade Stock are Shown at Right Side of Machine



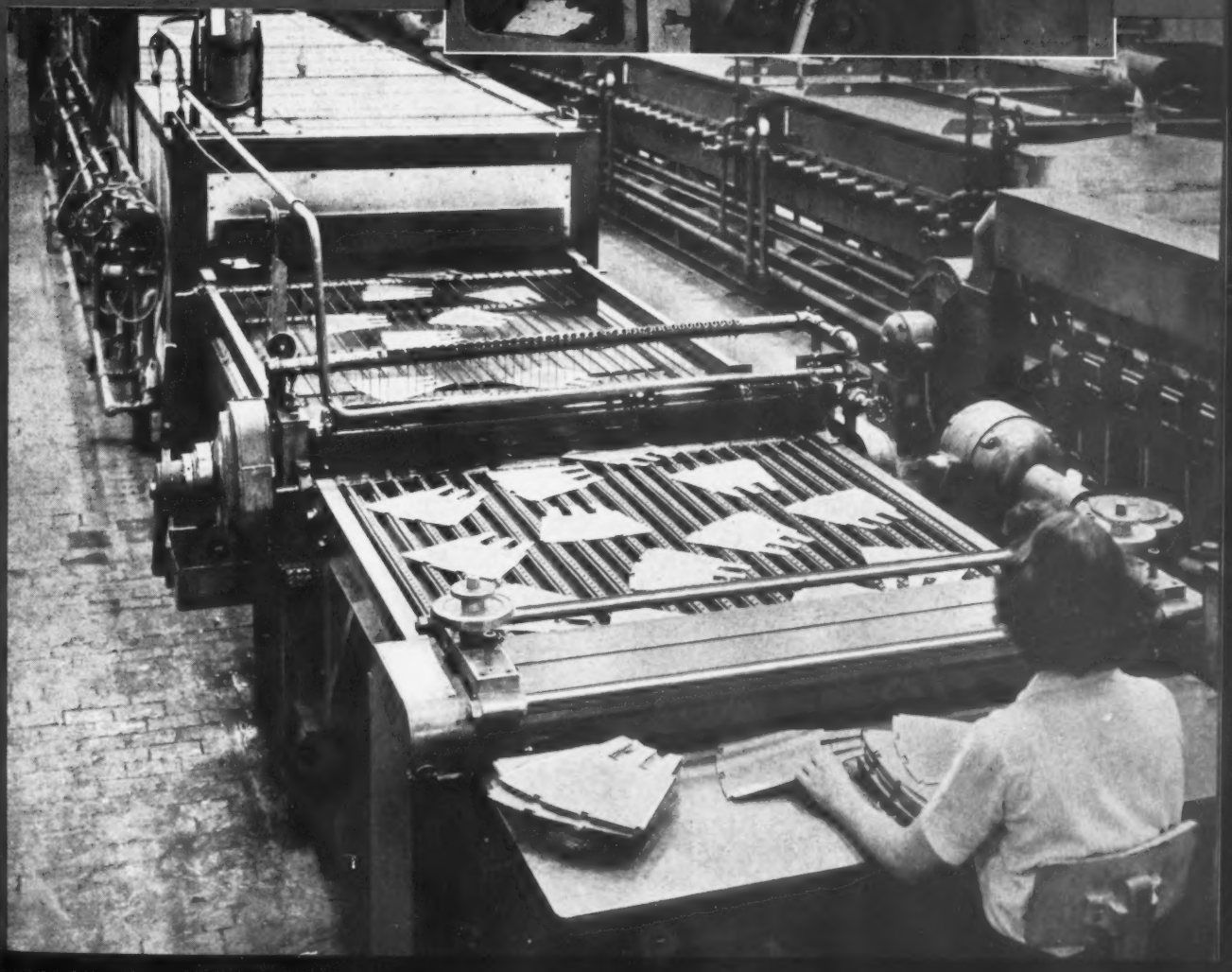
TURBINE GENERATORS

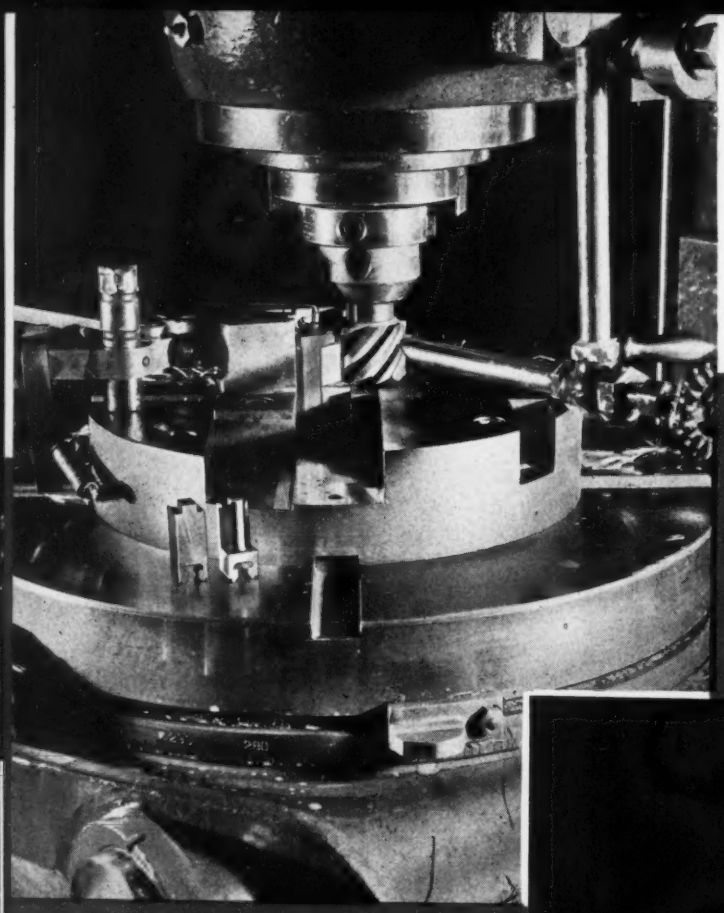
Navy

(Right) Drilling Square Hole in a Steel Forging that is Used as Turbine Rotor-shaft Extension. A Special Floating Drill Chuck and Three-fluted Drill are Employed in Performing This Operation

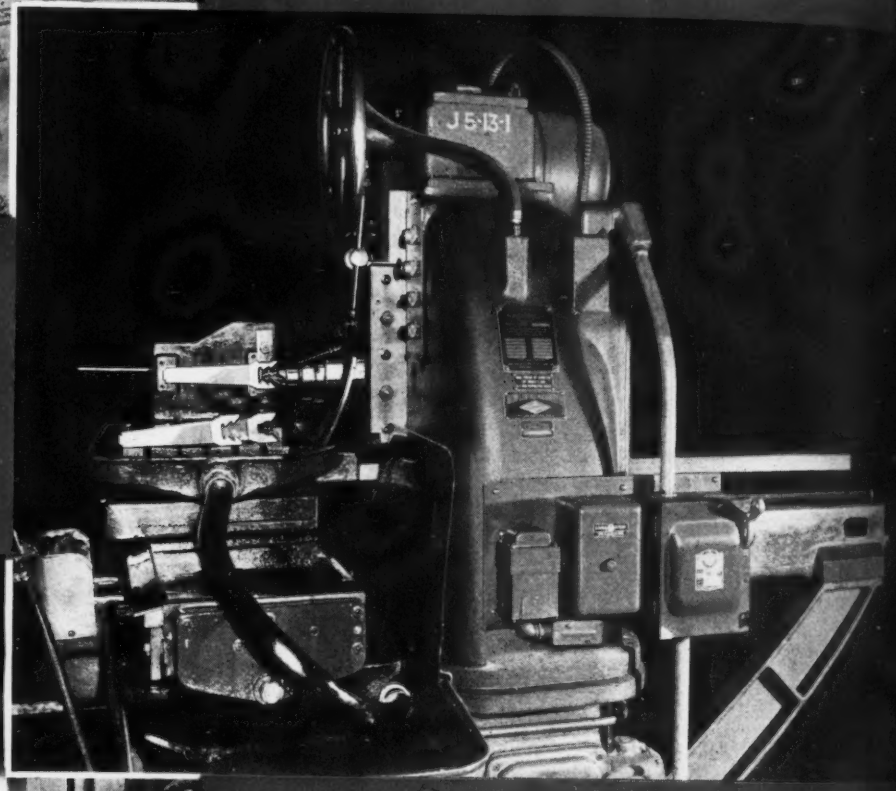


(Below) Flash Enamelling of Generator Stator Laminations. Four Lines of Punchings Travel through This 75-foot Painting and Baking Unit. The Operation Takes Only 1 1/2 Minutes

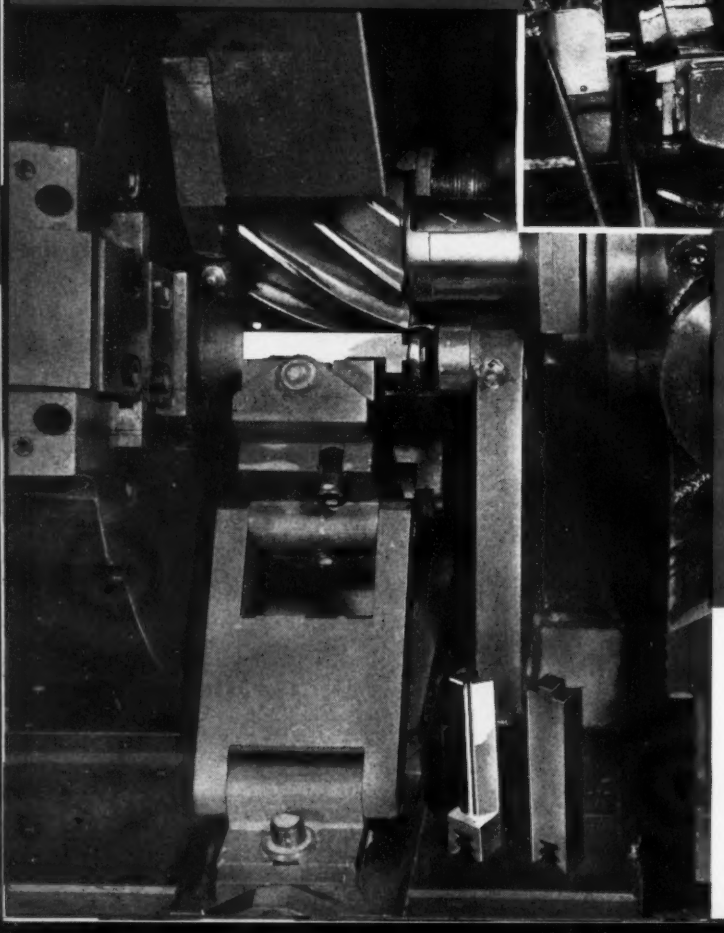




(Left) Two Straight Surfaces and Connecting Curved Surface are Milled on This Vertical Milling Machine to Form Back of Turbine Bucket. Unfinished and Finished Pieces are Shown in Foreground

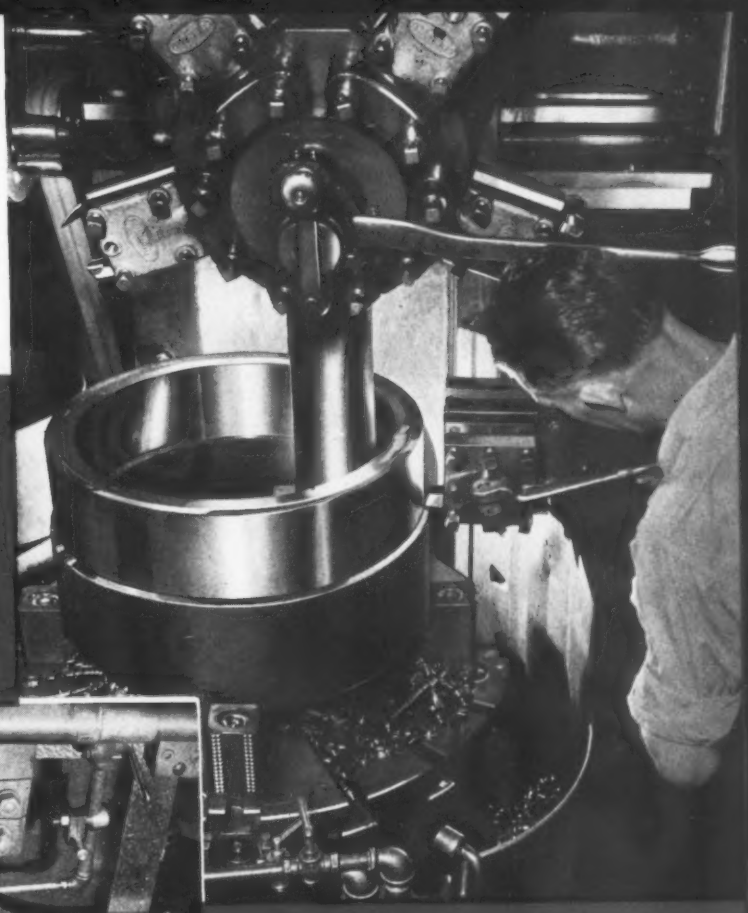


(Right) Special Milling Machine Designed to Cut Serrated Curved Slots in Turbine Bucket Bases. Work-piece is Swung in an Arc across Cutter. Finished and Unfinished Pieces Seen at Front of Table

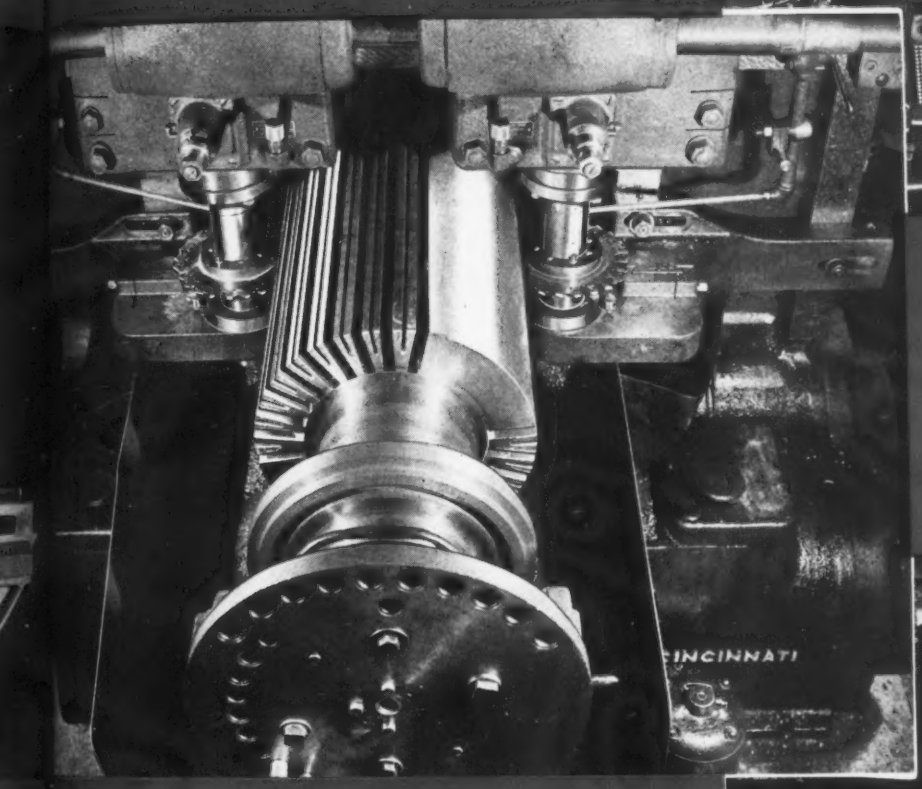


(Left) Similar Operation to that Shown in View at Upper Left Performed on Horizontal Milling Machine. Work is Rotated to Obtain Curved Surface while Table Traverse is Used for Straight Sides

GENERATORS FOR THE NAVY



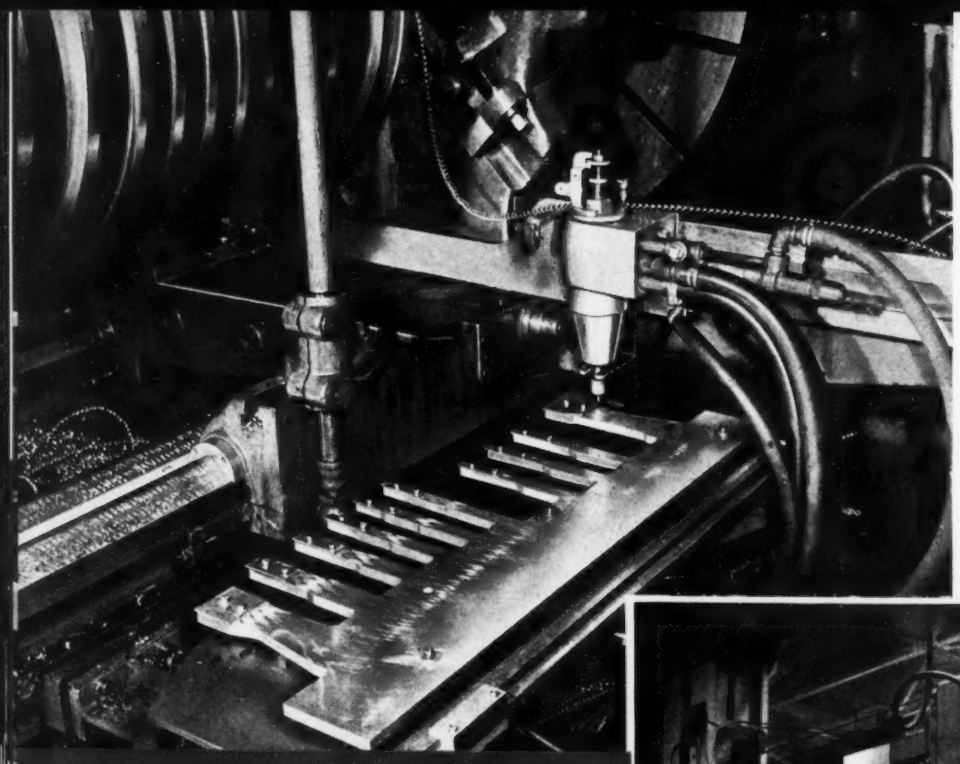
(Right) Simultaneously Boring and Turning a Generator Rotor Retaining Ring, Using Carbide-tipped Tools. Heavy Cuts are Taken at Considerable Speed with This High-strength Alloy Steel



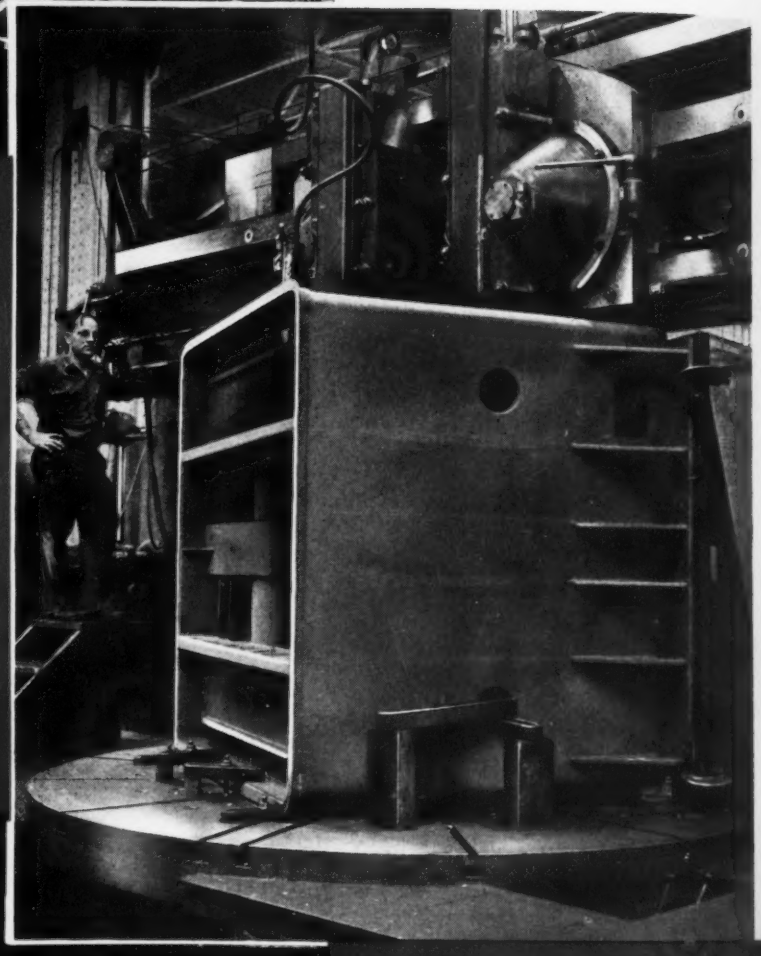
(Left) Milling Vent Slots in a Generator Rotor Two at a Time. Large Rectangular Slots are Similarly Milled on another Machine. The Indexing Plate in Foreground Positions Rotor for Operations

(Right) Two Halves of Diaphragm are Tack-welded to Semicircular Fixture which is Used to Quickly Position Work in Successive Operations. The Mating Surfaces of the Diaphragm are Seen being Planed

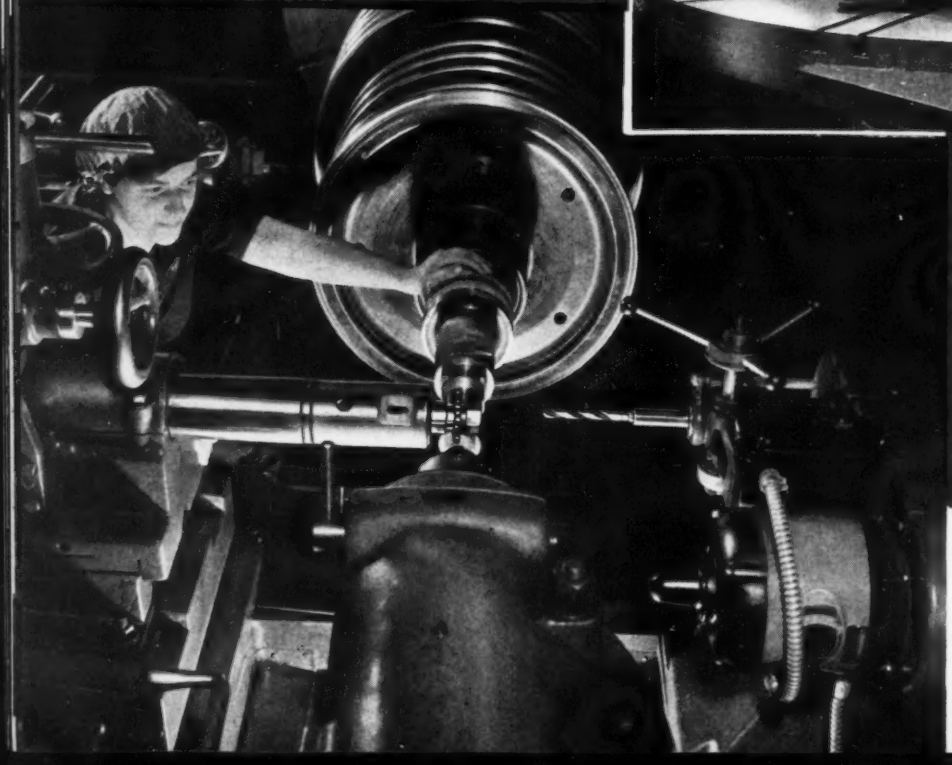
TURBINE GENERATORS



(Above) Rear View of a Lathe Showing Contour Plate and Follower that Hydraulically Control the Horizontal Motion of the Cutting Tool during its Continuous In-feed for Turning Turbine Rotor Stages



(Right) Boring the Generator Stator Frame. The Entire Frame is Fabricated by Welding, Saving Considerable Weight and Bulkiness



(Left) The Milling Head Shown at Left, the Drilling Head at Right, and the Shaper at Rear Left are Used in Successive Operations on a Turbine Rotor. The Rotor is Held between the Headstock and Tailstock of an Old Lathe

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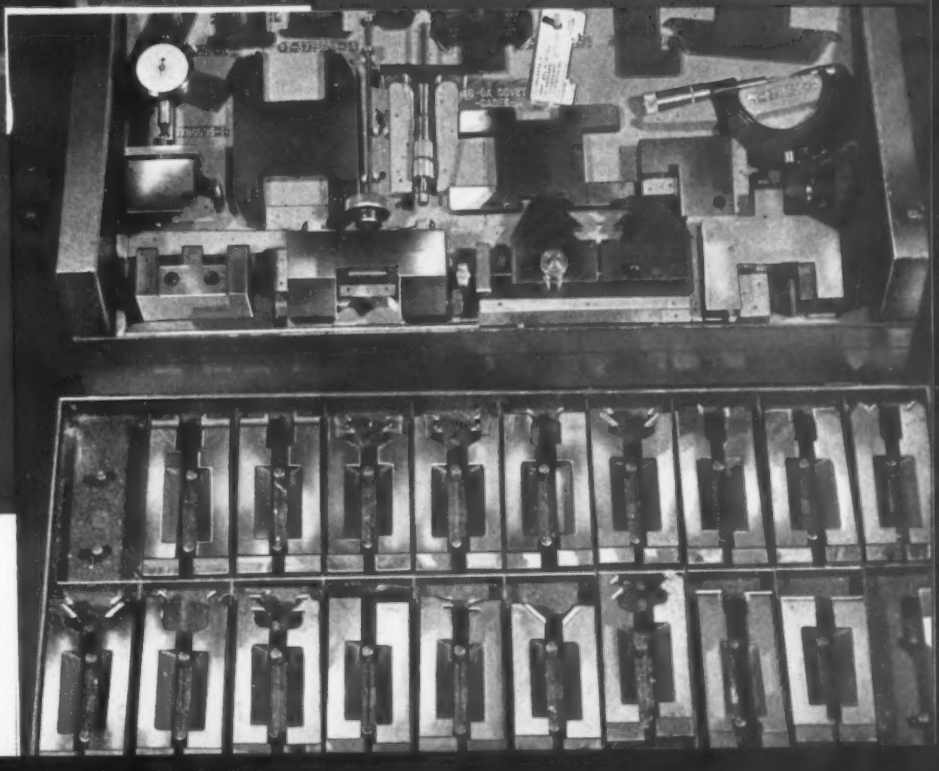
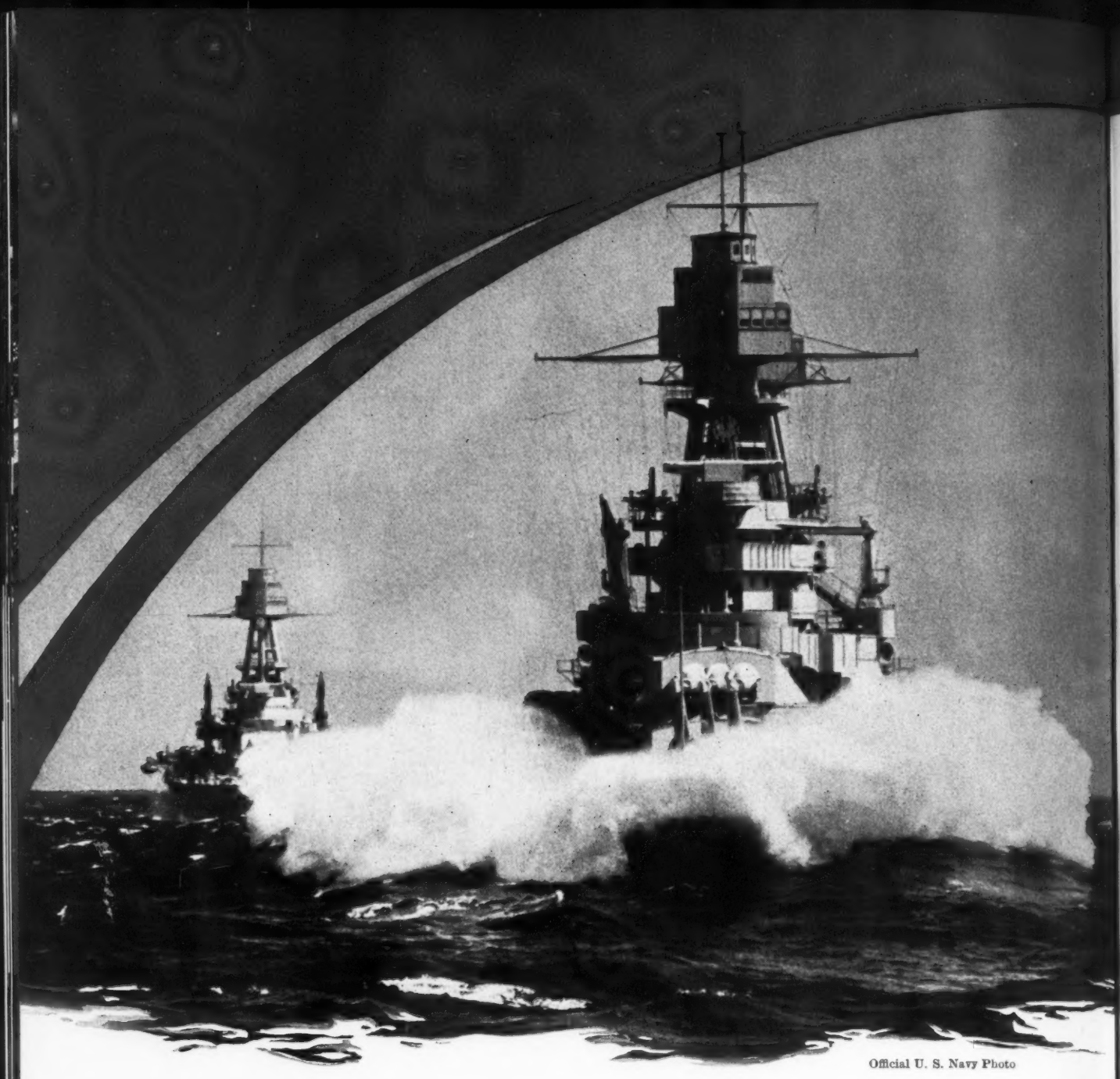
FOR THE NAVY

(Above) Shot-blast Chamber Capable of Handling Large Generator Stator Frame Weldments. Air Enters Chamber through Ceiling Vents and Passes out through Side-wall Outlets Carrying away Most of Dust and Fine Scale. Shot Drops through Perforated Floor-plate and is Reclaimed. Diver-like Helmet Worn by Workman has a Separate Air Supply

(Left) Governor Housing Fabricated from Thirty Pieces of Boiler Plate Steel is Assembled by Welding



(Right) Large Number of Forming Tools and Accompanying Gages Used for Turning Various Turbine Rotor Stages. These Tools and Gages have Made it Possible to Train Unskilled Men to Perform what is Ordinarily a Highly Skilled Operation



Official U. S. Navy Photo

HUGE CASTINGS FOR NAVAL VESSELS

from Birdsboro's New Foundry

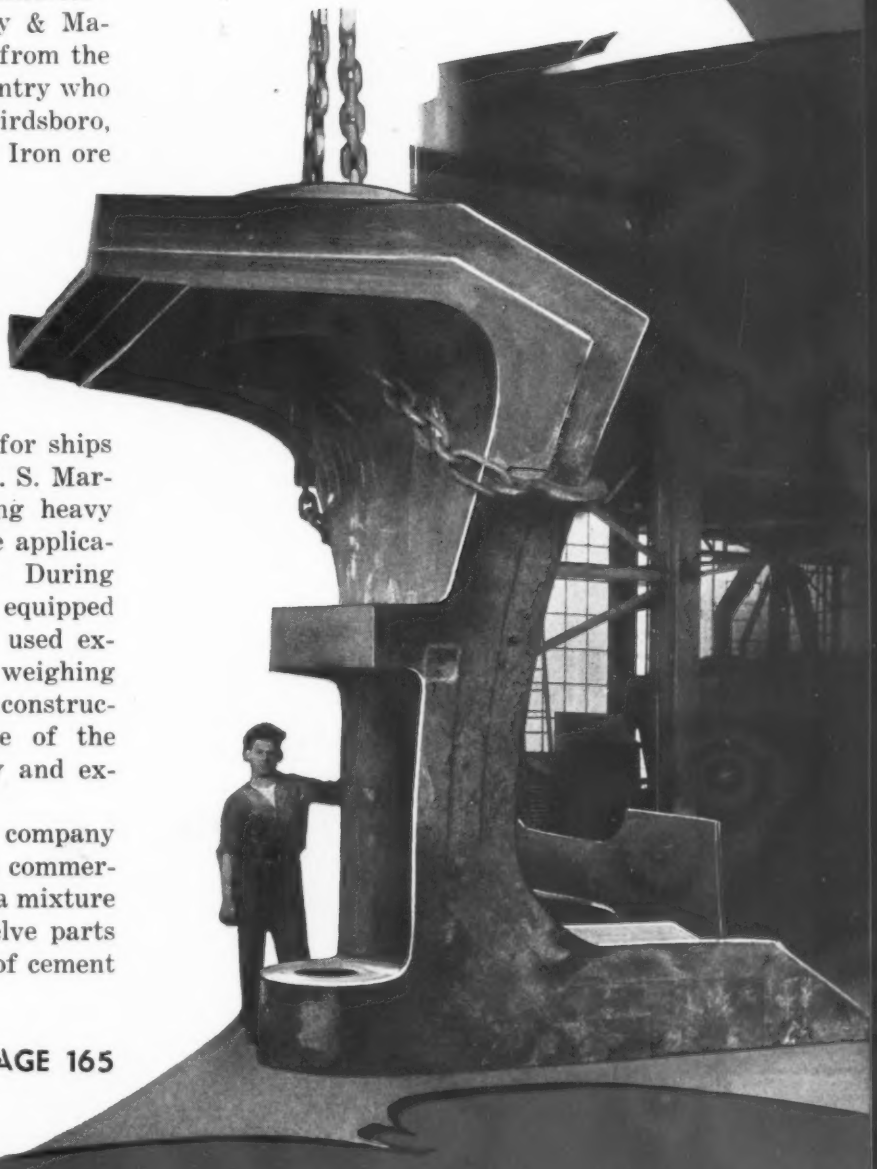
Eight Million Dollar Foundry Built to Produce Steel Castings for the United States Navy, which Has Everything Needed to Make it One of the Most Modern in the World

By CHARLES O. HERB

CANNON balls for the Revolutionary War were produced by the "lineal ancestor" of the Birdsboro Steel Foundry & Machine Co., for this concern has sprung from the pioneers of the iron industry in this country who built the Old Hopewell furnace near Birdsboro, Pa., more than two hundred years ago. Iron ore smelted in this furnace was mined from the adjacent hills. The present concern and its predecessors have helped our Government to wage all of its wars by supplying munitions and other requisites of warfare, and the present conflict is no exception.

Today the concern specializes in the production of heavy steel castings for ships built both by the U. S. Navy and the U. S. Maritime Commission, and also in building heavy hydraulic presses that are finding wide application in aircraft manufacturing plants. During the last year the Navy has erected and equipped an eight million dollar foundry to be used exclusively in turning out steel castings weighing as much as 190,000 pounds for ship construction. This article will describe some of the facilities of this ultra-modern foundry and examples of its products.

The Birdsboro concern was the first company in America to adopt cement molds on a commercial basis. These molds are made from a mixture comprising one part of cement to twelve parts of ordinary foundry sand. By the use of cement



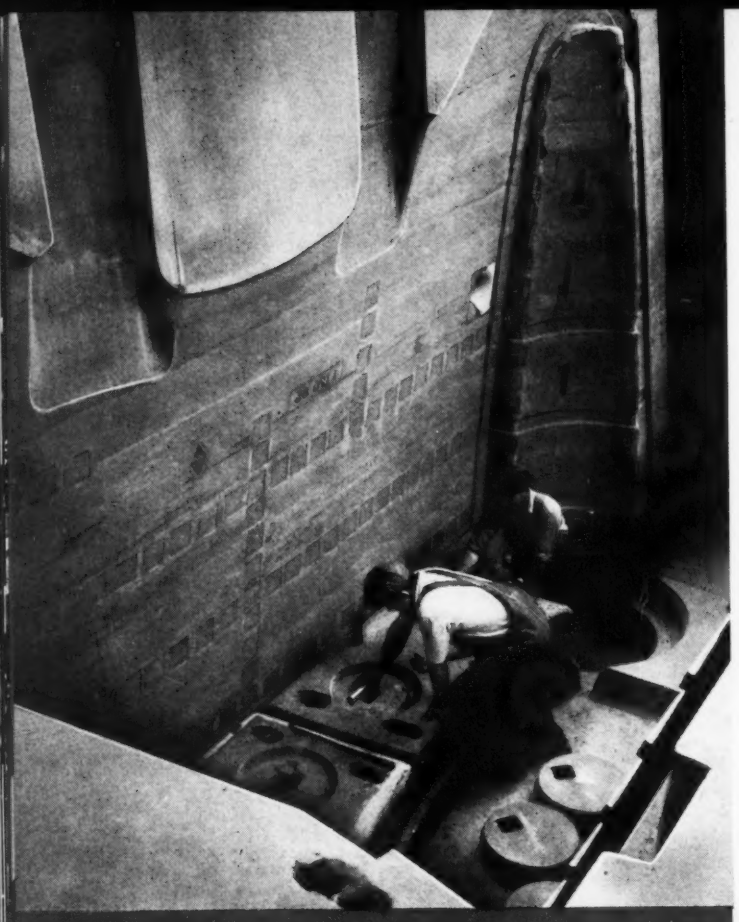


Fig. 1. (Above) For Convenience in Constructing and Pouring, Large Molds are Set up in Pits that are About 10 Feet Deep

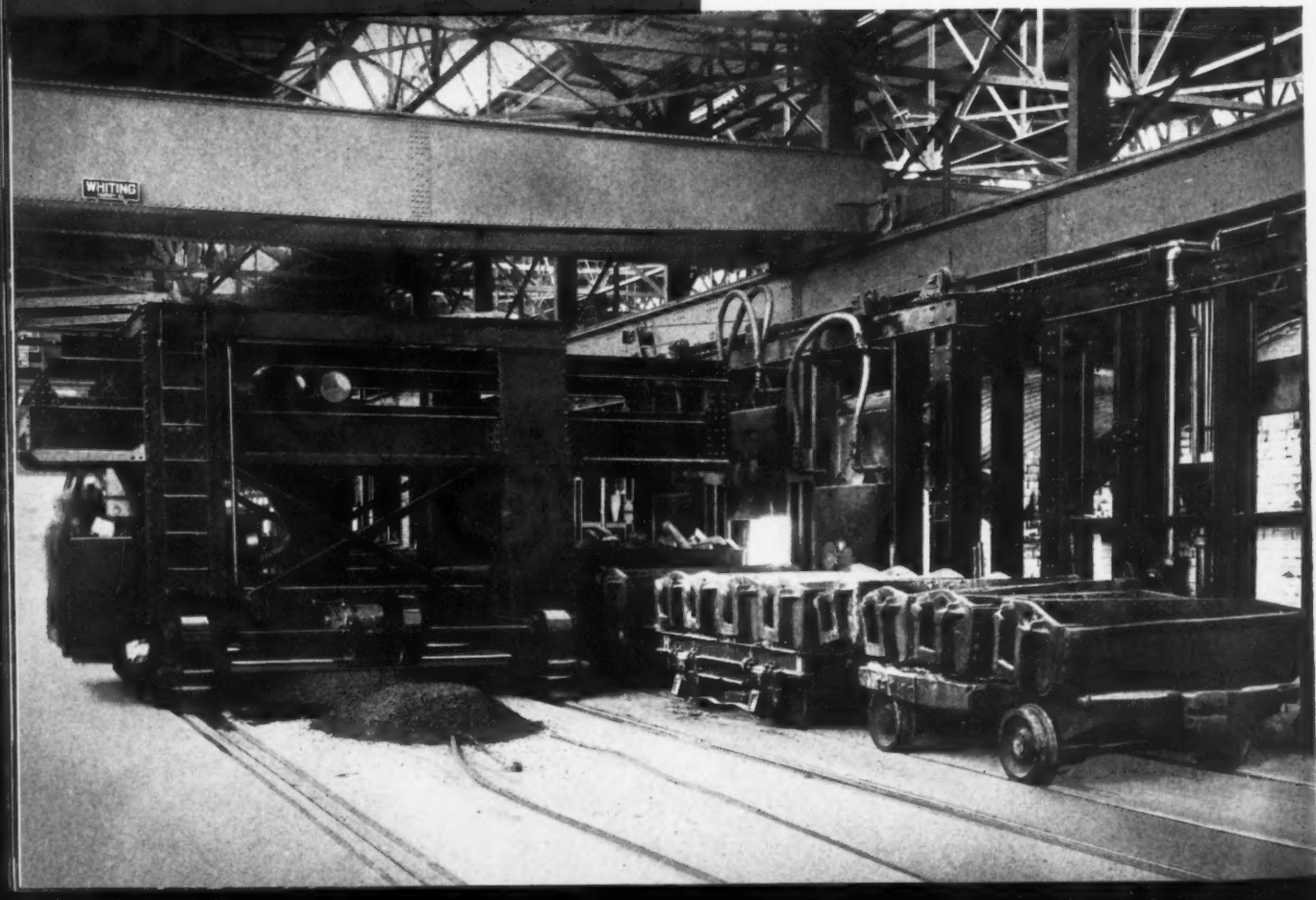
Fig. 2. (Below) General View of One of the Two Basic Open-hearth Furnaces in the New Birdsboro Foundry. The Big Charging Crane which Serves Both Furnaces is Seen at Left

HUGE CASTINGS FOR NAVAL VESSELS

in the molds, castings can be produced to closer tolerances than castings poured in regular sand molds, because of the greatly reduced expansion and shrinkage of cement molds.

Another outstanding advantage of cement molds is that no artificial drying is necessary. Although cement molds become much harder than regular sand molds, the material can be used over and over again by breaking up the molds into rubble after the castings have been taken out. This rubble can be used as a filler for the bulk of other molds; however, a new mixture of cement and sand is always applied to a thickness of at least 1 inch wherever the molds come in contact with patterns or cores. The new foundry is adequately equipped with machinery for mixing the sand and cement, breaking up the rubble, and delivering rubble and new mixtures to flask-filling machines or mold pits.

The building is 800 feet long by 470 feet wide, and has four bays, 50, 60, 70, and 80 feet in width. There are two basic open-hearth furnaces, each of which is capable of producing 95 tons of molten steel in one batch. Both furnaces are oil-fired. They are served by the floor type charging crane seen in Fig. 2, which has a heavy



ram that pushes bales of steel scrap and boxes of pig iron and other constituents, as well as the burnt lime that is used as a purifying agent, directly into the furnaces.

Pits are provided in this foundry for all large molds, as this makes for greater convenience. In Fig. 1, workmen can be seen in one of the pits setting cores in a mold that is of a size commonly handled in this foundry. A completely built-up flask for a large ship member is seen in Fig. 3. The ladle from which the molten steel is being poured into the mold in this flask is large enough to take the entire discharge of one furnace. Fig. 4 shows the appearance of the upper portion of the casting that was poured in this flask, the lower portion being still enclosed by the cement mold.

Considerable cleaning work is performed on castings before they are shipped from the foundry by the application of snagging grinders, pneumatic chippers, shot-blasting guns, and oxy-acetylene torches, the latter being used for cutting off risers and so on.

A typical operation in the snagging department is shown in Fig. 5, where a Mummert-Dixon grinder is being employed for grinding off rough spots on a stern post. The machine is suspended from a Shepard-Niles hoist mounted on a jib crane. With this arrangement, the grinder can readily be swung to any point on the casting, and can be raised and lowered to suit requirements.

Many castings are finished by shot-blasting. The smaller ones are shot-blasted while enclosed in circular booths of the type where the operator stands on a platform on the outside and inserts his arms through protected openings to handle the gun. He observes the progress of the operation through windows. Large castings are handled in the big shot-blasting booth illustrated in Fig. 6, which is approximately 36 feet long by 15 feet wide by 12 feet high. The castings are placed on a low flat car by an overhead crane, and this car is conveniently pushed in and out of the booth on a track imbedded in the floor.

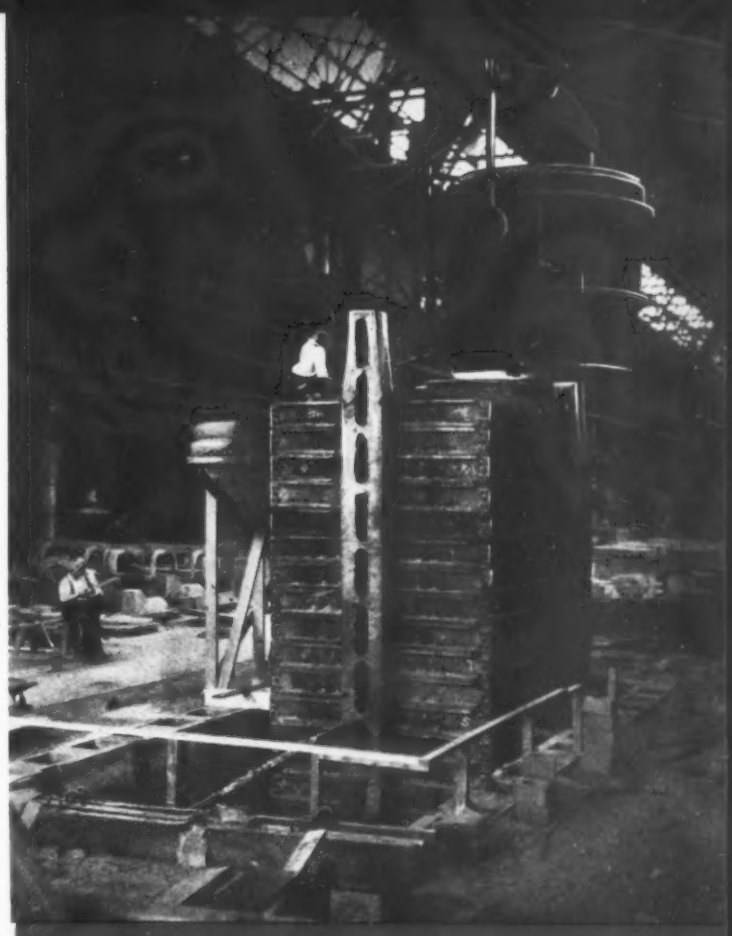


Fig. 3. (Above) Pouring Molten Metal into a Flask from a Ladle Large Enough to Carry an Entire Batch from One of the Furnaces

Fig. 4. (Below) View of the Casting Poured in the Flask Shown in Fig. 3, the Bottom and Back Portion of the Casting being Still Enclosed in the Hard Cement Mold

Fig. 5. Snagging Grinders Supported by a Hoist on the Boom of a Jib Crane Remove Rough Spots from Castings

The anchor seen being cleaned in the illustration was produced for a battleship and weighed 11,000 pounds.

The only machining operations performed in the foundry are to rough-bore some castings and rough-face surfaces at the ends of bored holes. These cuts are taken on Underwood boring machines of the type illustrated in Fig. 8, which shows a ship strut bearing being machined. For boring operations, two or three cutters are customarily mounted on the tool-head and the latter is fed through the work by the action of a lead-screw on the revolving boring-bar. This screw engages a nut on the tool-head. In facing operations, a tool is used that is wide enough to cover the width of the surface being machined. The revolving cutter is then fed straight into the surface. About a half dozen cuts are taken in boring to machine to the required depth.

The machine illustrated is equipped with a 6-inch boring-bar; there are also 8- and 10-inch bars on hand which can be quickly mounted on the machine to suit larger work diameters. The work is mounted on a carriage that runs on a floor track.

All castings produced in this foundry are heat-treated in annealing furnaces, an operation that requires as long as seventy-two hours in the case of some large castings. The shortest period is approximately twenty-four hours. Furnace stress-relieving temperatures run anywhere from 1100 to 1700 degrees F., depending upon the nature of the heat-treatment, the composition of the casting, and its size.

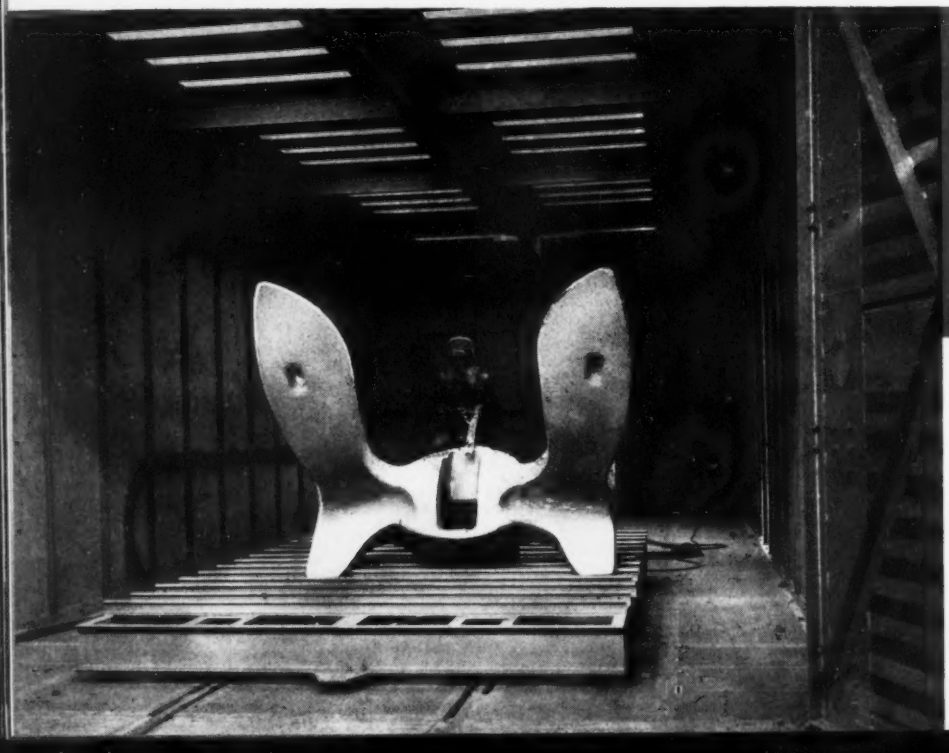


Fig. 6. Large Castings are Shot-blasted in a Booth Provided with a Floor Truck that Facilitates the Handling of Heavy Work

Annealing operations are performed in one of three furnaces, the smallest of which has inside dimensions of approximately 25 feet long by 9 feet wide by 6 1/2 feet high, and is fired by twenty-four oil burners. The middle-sized furnace is 50 feet long by 16 feet wide by 14 feet high, and is fired by forty-four oil burners, while the largest furnace is 50 feet long by 18 feet wide by 16 1/2 feet high, and is also fired by forty-four oil burners. The work is loaded on flat cars for carrying into and out of the annealing furnaces.

X-ray equipment of one million volts has been installed in a separate room for careful checking of castings in order to locate invisible flaws. A view of this equipment is shown in Fig. 7. The X-ray machine is mounted on the lower end of a pantograph structural arm which can be quickly adjusted to suit castings of all types. The structural arm is permanently mounted on an overhead crane.

The remaining illustrations, Figs. 9 to 13, show typical ship castings produced in this foundry. The weird-looking casting in Fig. 9 is a rudder frame for the battleship of one of our Allies. It weighs 37,000 pounds. Fig. 10 shows a rudder main-piece for one of our battleships. This casting has a weight of 48,000

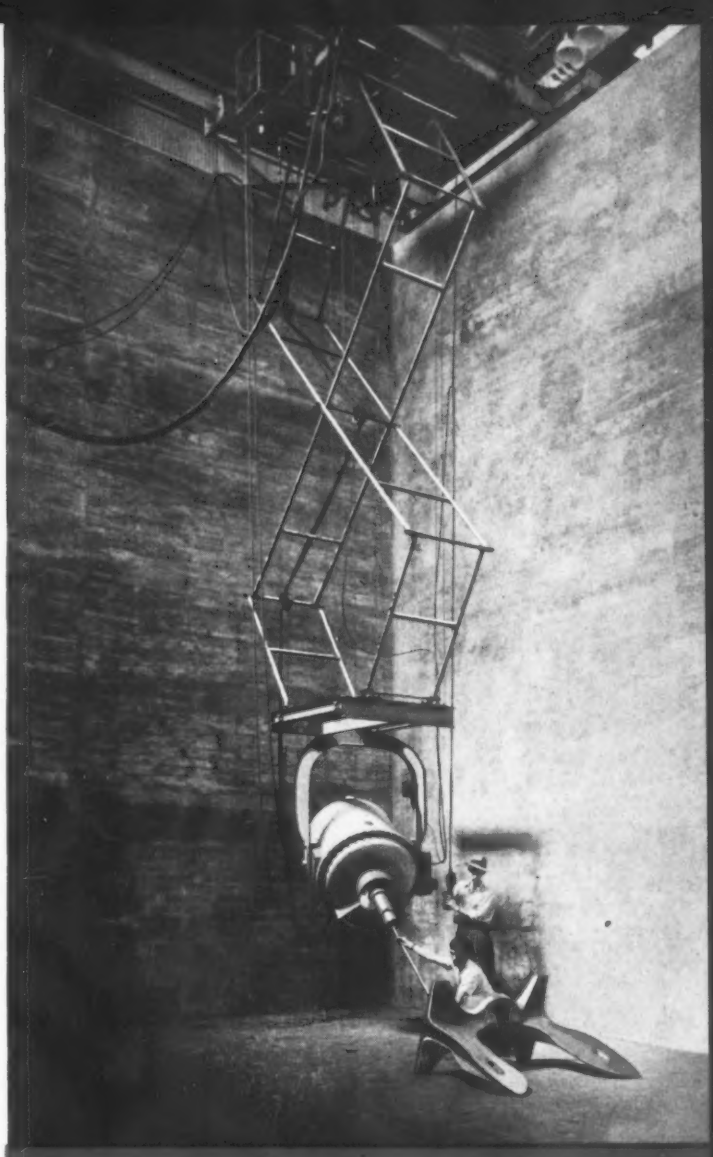


Fig. 7. (Above) A One-million Volt X-ray Machine Suspended from an Overhead Crane by Pantograph Structural Arm is Employed for Detecting Flaws in Castings

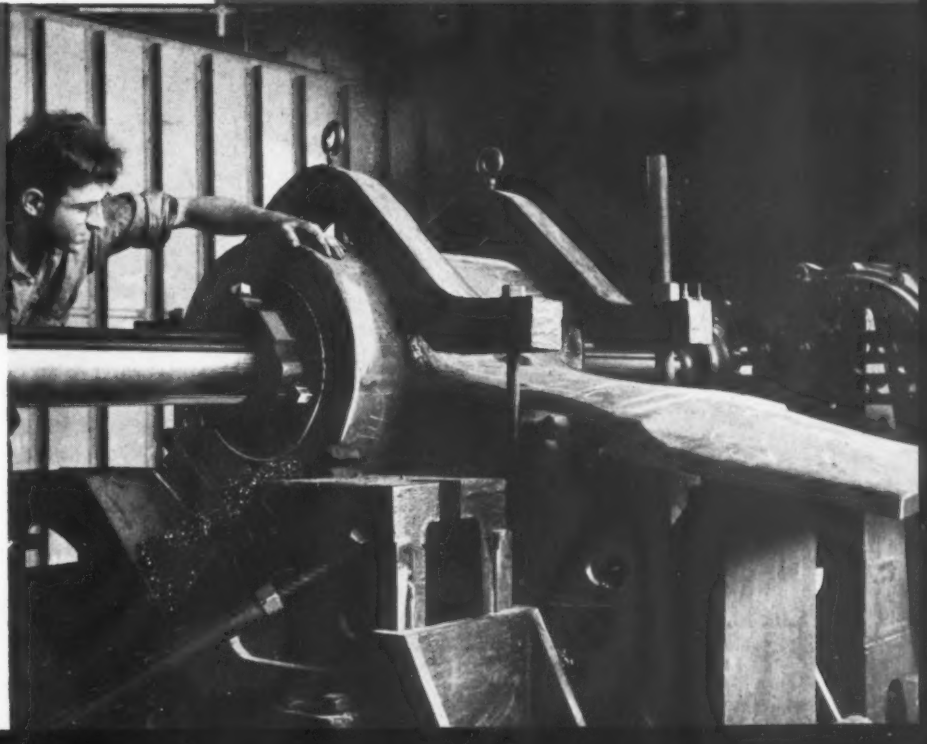


Fig. 8. (Right) An Underwood Boring Machine of the Type Used for Performing Rough-boring and Rough-facing Operations on Heavy Castings

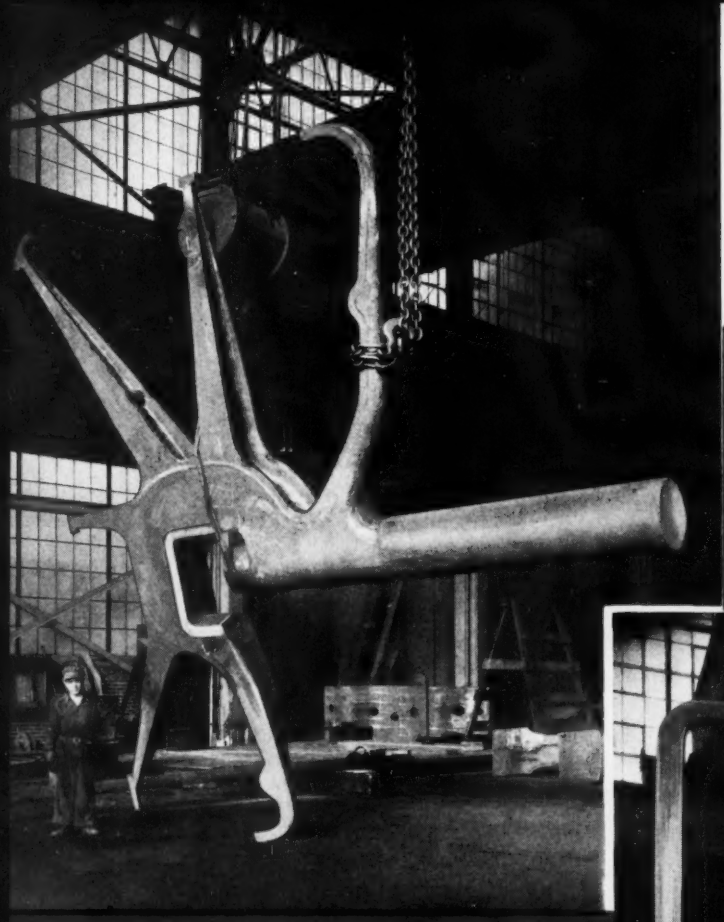


Fig. 9. (Left) The Rudder Frame for a Large Battleship Having Long Arms of Comparatively Slender Cross-section that Presented Foundry Difficulties

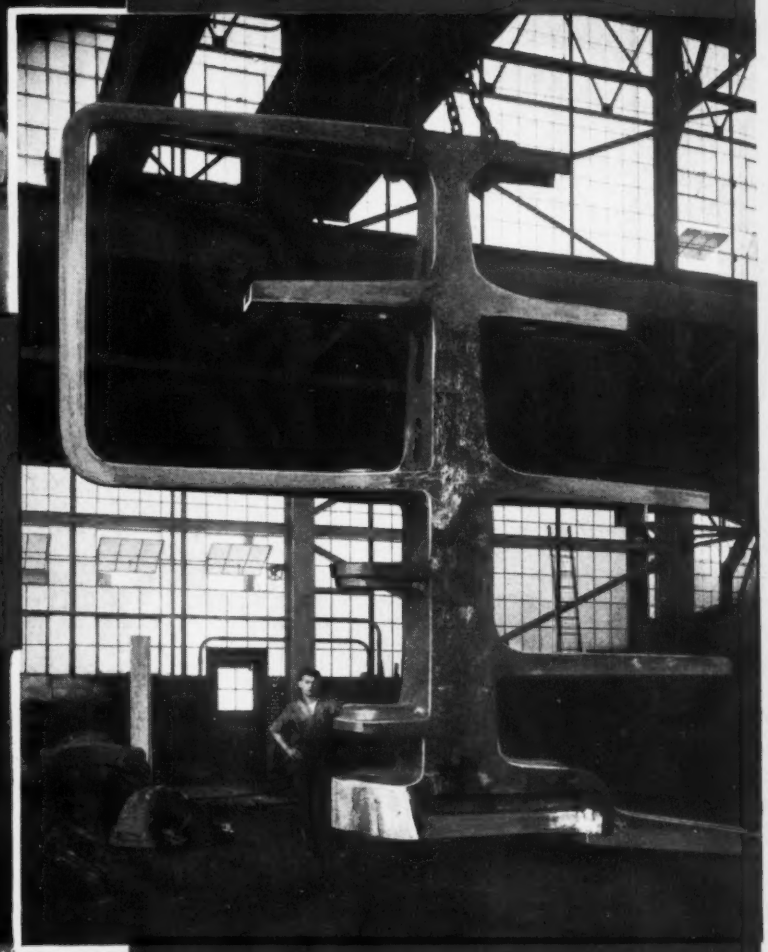


Fig. 10. (Right) Rudder Mainpiece for One of Our Battleships, which has a Weight of Approximately 48,000 Pounds

Fig. 11. (Left) Large Ship Strut Casting which has a Weight of More than 75,000 Pounds

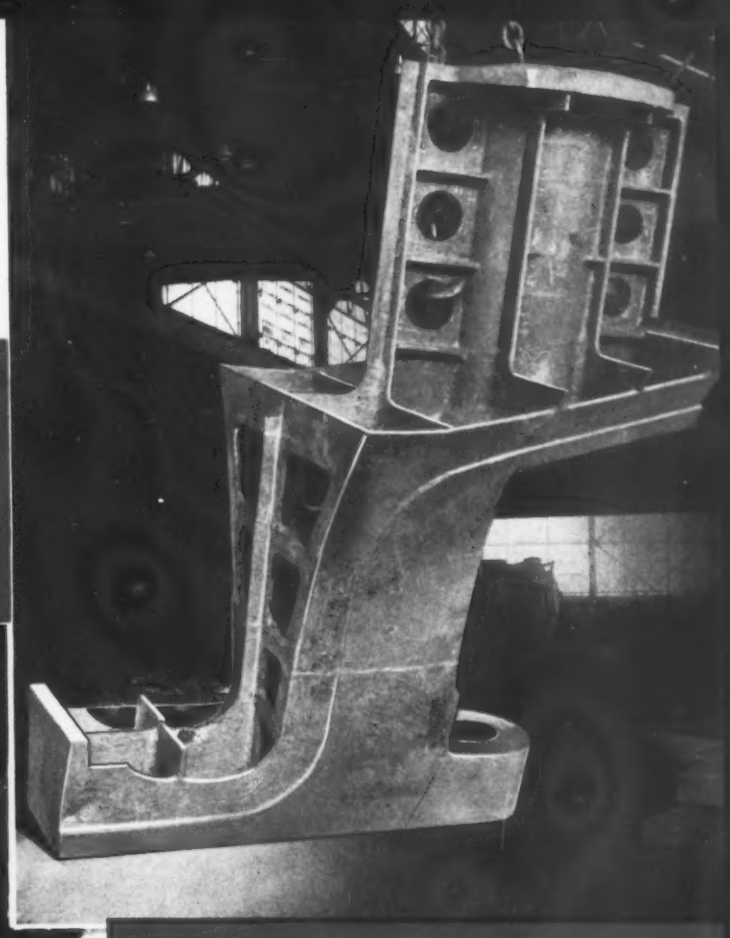


Fig. 12. (Right) Stern Post with Somewhat Complicated Coring—another Example of Large Castings Required in Shipbuilding. This Casting Weighs 42,000 Pounds

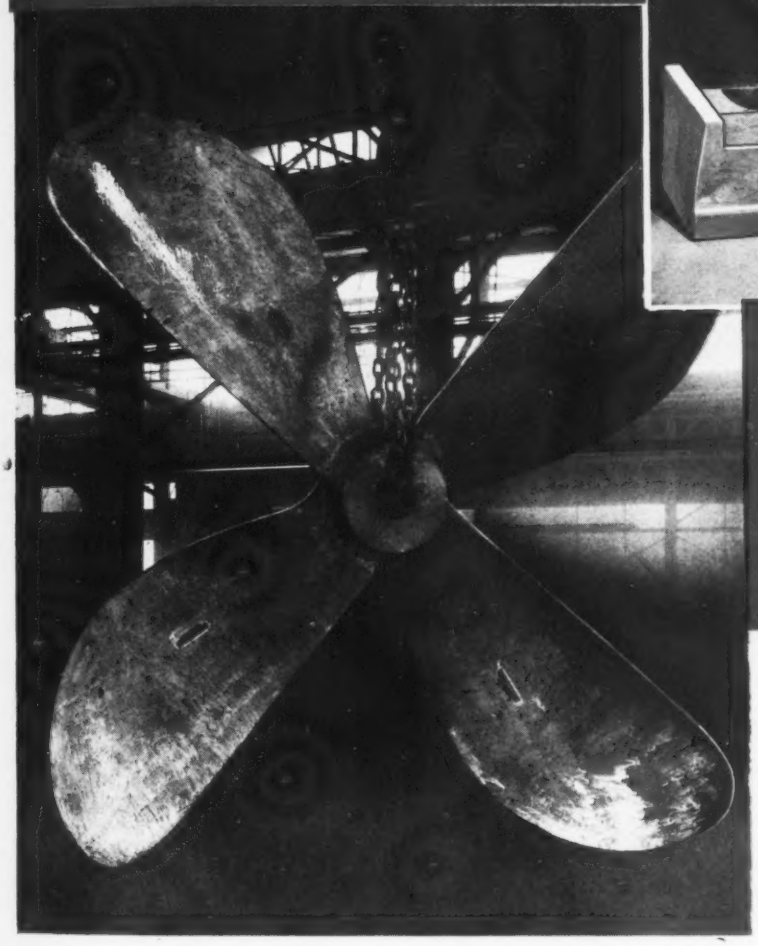


Fig. 13. (Left) Steel Propeller 18 1/2 Feet in Diameter Made for a Merchant Vessel Built by Maritime Commission

pounds. In Fig. 11 is shown a ship strut that weighs 75,000 pounds, while Fig. 12 shows a stern post which weighs almost 42,000 pounds. The propeller seen in Fig. 13 is unusual in that it was cast of steel, whereas propellers in the past have almost universally been made of bronze. This propeller was produced for a merchant vessel built by the Maritime Commission. It has a diameter of 18 1/2 feet and weighs approximately 24,000 pounds.

Because of the large dimensions and heavy weight of the castings produced in this foundry and the long comparatively slender sections which extend from some of them, it is obvious that problems are daily presented that necessitate drawing upon years of practical experience.

THE SPERRY *Dependable Instrument*

This Highly Precise Instrument Provides a Continuously Accurate Directional Reference that Greatly Aids Exact Navigation. The Model Described Here is Used in the New Destroyer Escort Vessels

By HOLBROOK L. HORTON

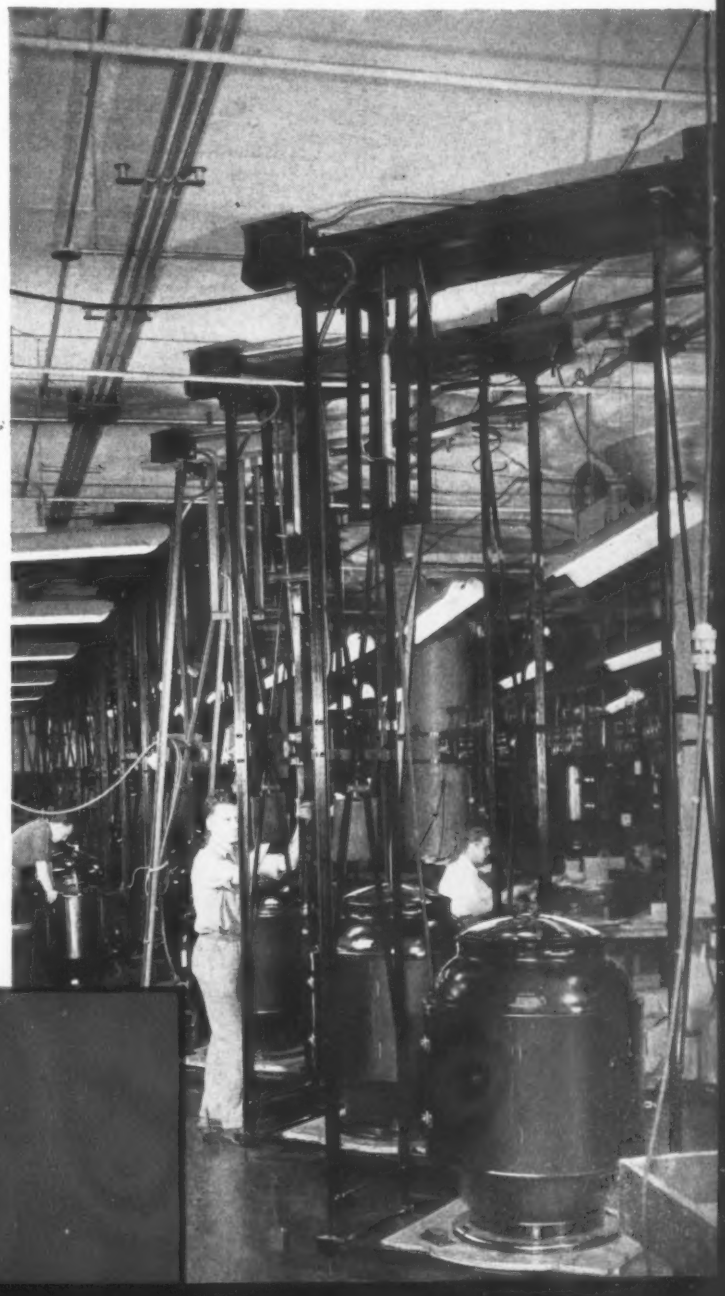
GYRO-COMPASS *of Navigation*

MODERN navigation no longer depends upon the variable magnetic compass, the accuracy of which may be affected by magnetic material in the ship or cargo, or even by electrical storms. Instead, the undeviating gyro-compass, the direction of which is governed by the earth's rotation, is now widely employed on both naval and merchant vessels.

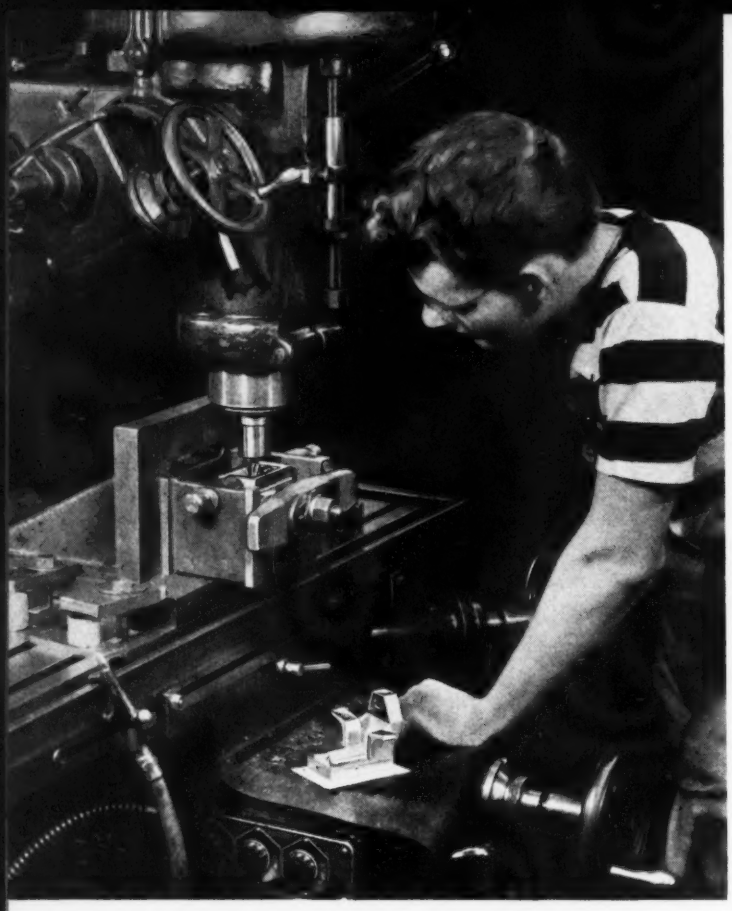
This instrument has several advantages as compared with the magnetic type of compass. The gyro-compass indicates the geographic or true north rather than the magnetic north. It is not given to wide variation or swing in heavy seas or to slight variation when the course is changed. The 55-pound rotor of the gyro-compass, spinning at 6000 R.P.M., gives it a directive force one hundred and fifty times as great as that of the magnetic compass, and causes it to remain fixed on the true meridian without the least tendency to follow the ship's head. It can be used with an electrically operated repeater system, which provides stations at one or more points about the ship where the indications of the master compass are duplicated for convenient observation. The gyro-compass can be used in conjunction with automatic steering by a gyro pilot, and it can also be employed in conjunction with the taking of bearings by radio and radar.

Gyro-compasses are now standard equipment on United States naval vessels, and several types are produced for this purpose. The machining operations described in this article are all on the Mark XIV compass, which is being used on the new destroyer escort vessels, as well as nearly all merchant ships.

The sensitive element of the gyro-compass consists of three main parts—a rotor which acts both as a small gyroscopic flywheel and as the rotor of an induction motor; a case which completely encloses the rotor and holds the stator of the induction motor inside a recess in the rotor; and a vertical ring which supports the rotor case on horizontal bearings. Application of alternating current to the stator winding in



Gyro-compasses being Subjected to a Preliminary Swing Test which Permits the Operator to Observe the Functioning of the Compass and Make Initial Adjustments



THE SPERRY GYRO-COMPASS

the rotor case produces a rotating magnetic field which causes the rotor to revolve at a speed of 6000 R.P.M.

The entire sensitive element is supported by a steel wire which is attached to the top of the vertical ring. This combination of horizontal bearing support and vertical steel wire suspension permits the sensitive element to position itself with the least amount of friction in accordance with the combined action of the gyroscopic force of the rotor, the force of gravity, and the rotation of the earth.

A vertical phantom ring which rotates only in a horizontal plane is driven by an azimuth motor in such a way that it follows every horizontal movement of the sensitive element and "reports" this movement to repeating compass stations about the ship.

In addition to these elements, there is a mercury ballistic, which causes the sensitive element to constantly seek to align itself with the meridian or true north-south line drawn through the geographic poles, and thus, in effect, converts it from a simple gyroscope to a gyroscopic compass. A compass frame or spider element supports the phantom element on a vertical thrust bearing so that it can freely follow the movement of the sensitive element about a vertical axis. Other elements provide means for correcting the setting of the compass in accordance with the speed and latitude of the ship. A binnacle supports and provides a protective housing for the master compass.

Many small and accurately formed parts make up these various elements, and careful machining is required. One illustration of this is shown in Fig. 1, where the inside faces of the corrector frame—part of the device used to correct the compass setting for the ship's speed and latitudinal position—are being milled on a Gorton vertical milling machine to form a slot 1.3740 inches wide within a tolerance of 0.0005 inch in width and 0.0003 inch in center location. The

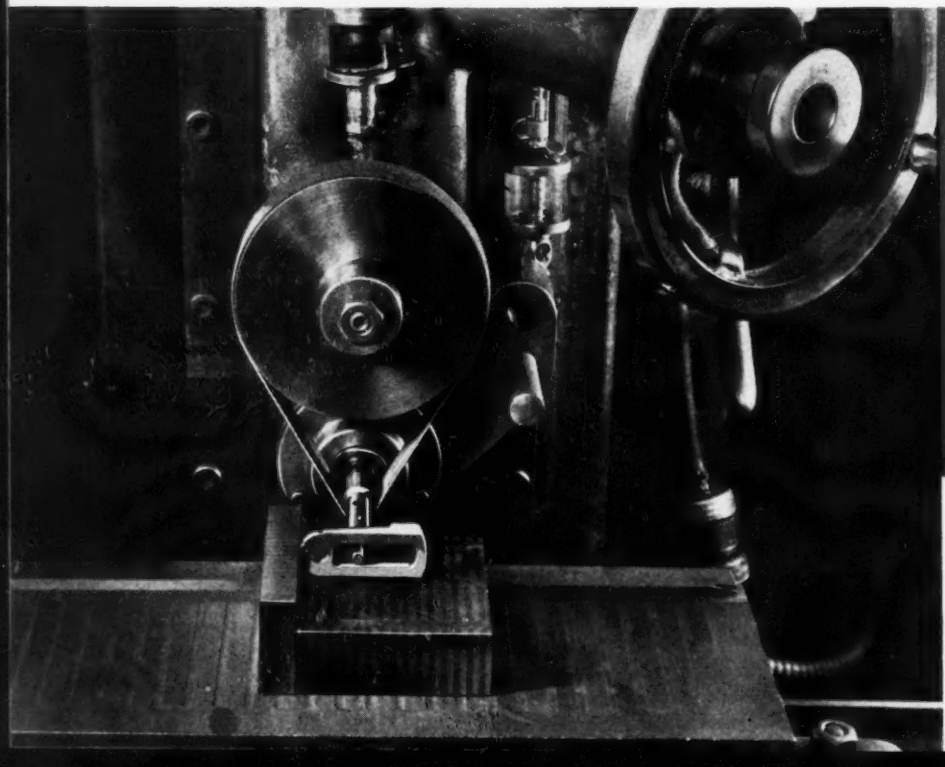


Fig. 1. (Above Left) Milling Inside Faces of Corrector Frame to a Tolerance of 0.0005 Inch. Tolerance for Center Location is 0.0003 Inch

Fig. 2. (Left) Grinding Upper and Lower Faces of Corrector Lever with High-speed Head

work-piece, which is a bronze casting, is held in place on a tapered locating pin at each end near the top and a larger supporting pin at the bottom. The supporting fixture is held firmly against an angle-plate, so that the work is maintained in a vertical position.

Another accurate machining operation on a small part is the high-speed grinding of the upper and lower faces of the corrector lever—another part of the latitude and speed correction device—as shown in Fig. 2. The small grinding wheel rotates at about 25,000 R.P.M., and is belt-driven from a Gallmeyer & Livingston grinding machine spindle rotating at about 3800 R.P.M. Two magnetic blocks located on an O. S. Walker magnetic chuck hold the work-piece in the correct position. The width of the slot, which is 0.5000 inch, is held to a tolerance of 0.0006 inch.

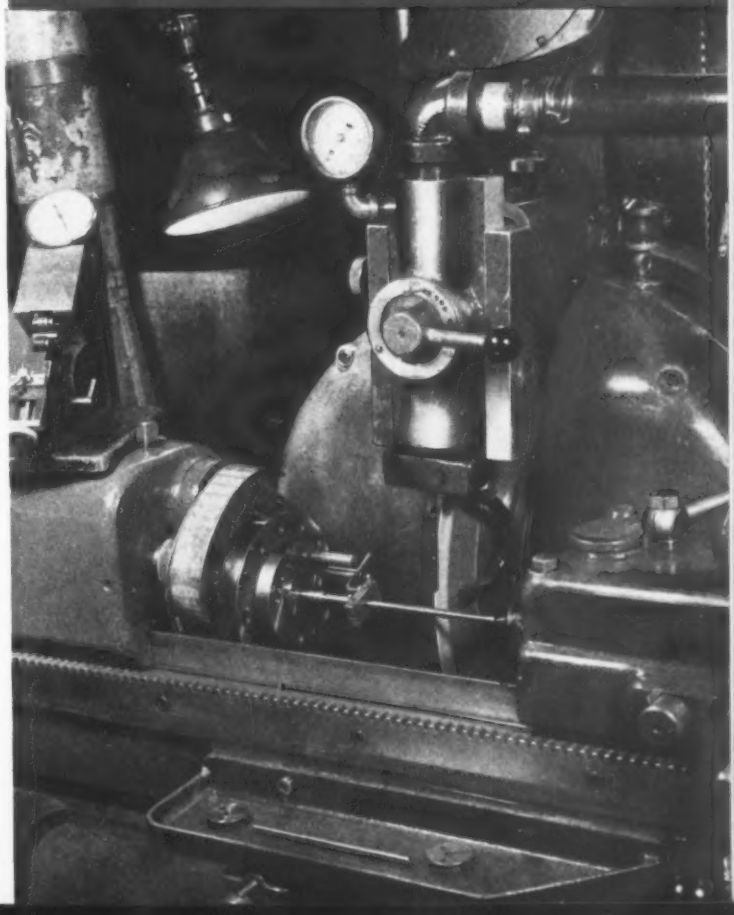
An interesting profile milling operation performed on a Van Norman vertical milling machine is shown in Fig. 3. A spiral cut with a lead of 6.112 inches is being taken on the lost-motion hammer of a transmitter which is used to transmit bearing readings from the master compass to the repeater stations. A 1 2-inch diameter right-hand cutter is used to take a right-hand spiral cut. A tolerance of 1 2 degree is allowed in the total angle of 53 degrees 12 minutes. The work-piece is an aluminum casting.

In Fig. 4 is shown a very fine pitch Class 4 thread being ground on a corrector-block shaft, using a disk wheel in a Jones & Lamson thread grinder. A finished work-piece is shown in the foreground between the "Go" and "No Go" gages. After a preliminary inspection with these gages, the corrector block itself is used as a final check on the correct size and profile of the thread.

In some cases, a relatively simple adapting fixture has enabled the Sperry Gyroscope Co. to utilize a machine for an operation quite different from that for which it was designed. An excellent example of this is the conversion of the

Fig. 3. (Above) Milling a Spiral Profile on a Lost-motion Commutator Transmitter

Fig. 4. (Below) Grinding Class 4 Thread of Fine Pitch on a Corrector-block Shaft



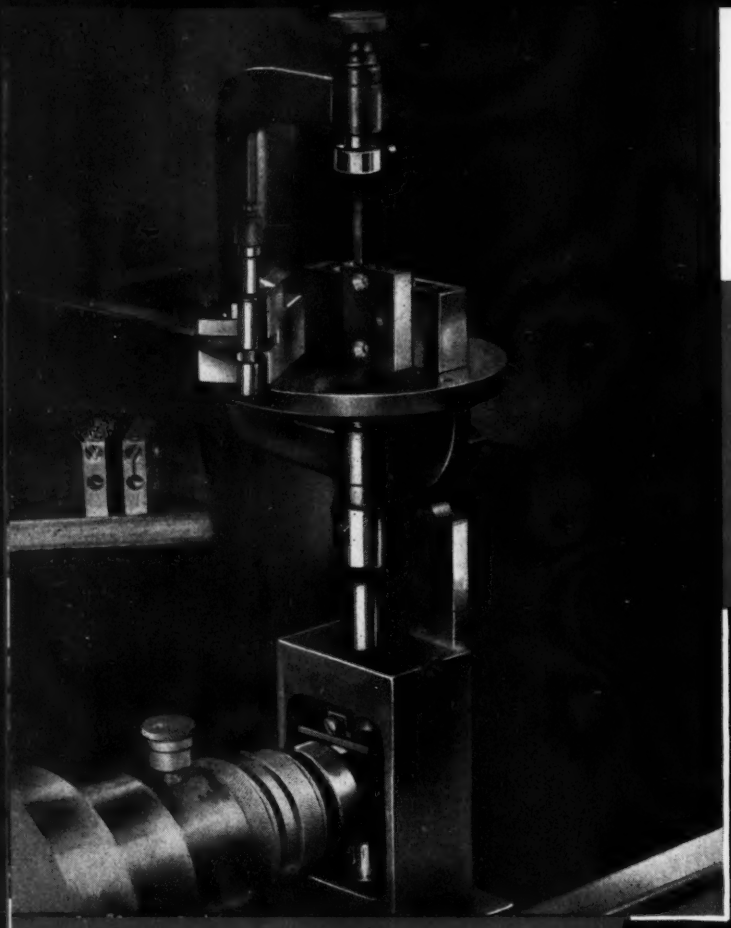


Fig. 5. (Left) Cutting a Slot in a Corrector Block, Using a Bench Lathe Converted to Operate as a Metal-cutting Jig Saw

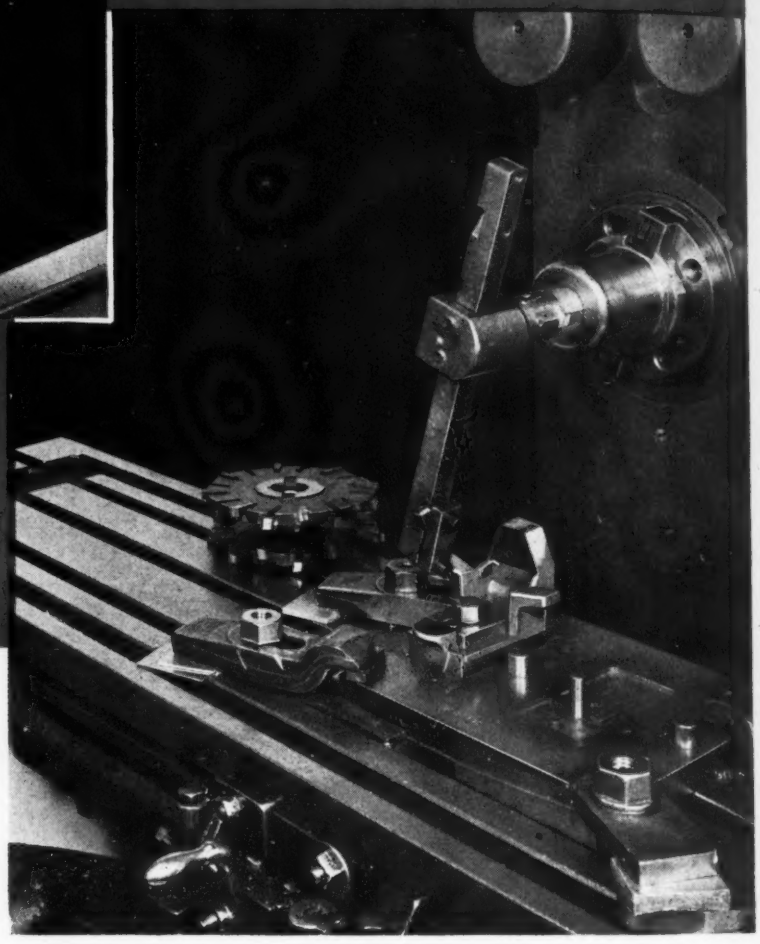


Fig. 6. (Right) Taking a Curved Cut on Two Flanges of a Corrector Frame with a Fly Cutter

Stark bench lathe shown in Fig. 5 into a small metal-cutting jig saw. The crank arrangement shown converts the rotary motion of the head to a vertical reciprocating motion. The operation being performed consists of cutting a 1/32-inch slot between two holes of 1/4-inch diameter in a brass corrector block. The block is held between the guide faces of the two holding blocks, and the hand-lever at the left is pulled forward, so that the block is fed toward the rear by the rollers bearing against the front end.

Another interesting operation is shown in Fig. 6. Here a fly cutter is being used on a horizontal milling machine to take a curved cut on two flanges of the corrector frame. The milling cutter shown in the background is used to straddle-face the upright part of the frame in a subsequent operation. Four other operations are performed on this machine with the aid of the holding fixture shown.

In Fig. 7, the upper end frame of a repeater is being reamed to a diameter of 0.6297 inch

Fig. 7. (Right) Reaming a Hole in the Upper End Frame of a Repeater to a Tolerance of 0.0006 Inch

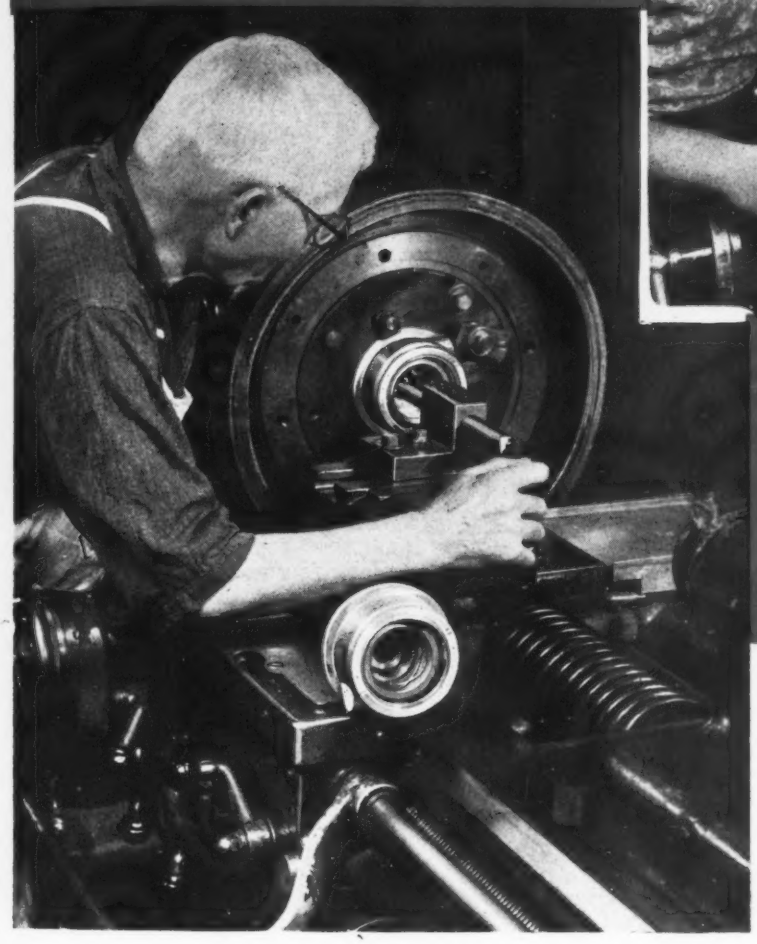


Fig. 8. (Left) Unusual Arrangement for Cutting Wave-shaped Oil-groove in Rotor-bearing Housing

within a tolerance of 0.0006 inch on a Warner & Swasey turret lathe. Previous operations on this piece performed on this machine consisted of facing the boss to a height of 1/8 inch, drilling a 19/32-inch hole, and rough-boring and chamfering the hole. The work-piece is a bronze alloy casting.

A somewhat unusual arrangement for performing an oil-grooving operation is shown in Fig. 8. A large heavy spring is inserted between the tool carriage and the tailstock of a Pratt & Whitney lathe. A roller attached to the farther side of the carriage is held against a cam fixed to the faceplate. The pressure of the spring maintains contact between the carriage, roller, and cam-ring. As the faceplate revolves the cam causes the carriage to move laterally back and forth so that a wave-shaped oil-groove is cut in the aluminum-alloy casting that forms the rotor-bearing housing.

An ingenious arrangement for assembling the repeater base and column is shown in Fig. 9.

The first operation (not shown) is to place the column in a horizontal position on rollers which rotate it for tinning that part of its length which is to be inserted in the base. In the next operation, the base is placed in the position shown and the socket is heated by an oxy-acetylene torch as the base is revolved. Solder, placed inside the socket, distributes itself fairly evenly over this surface as the base is rotated. A final hand-wiping removes the excess solder and evens out the remainder into a smooth coating.

The base is then placed in an upright position on a rotating table, the column is dropped into place, and the two pieces are sweated together, using another oxy-acetylene torch. In actual practice, a large number of columns are first tinned on the outside and then the tinning of the base socket and assembly of the base and column progress simultaneously as shown.

On account of the high speed of the rotor, it must be balanced exactly, and for this purpose the cathode-ray oscillograph type of balancing machine, shown in Fig. 10, is used. This machine was built by the Research Laboratories Division of the General Motors Corporation. The vibration set up by the rotor after it has been brought to speed and then allowed to coast is transmitted as an electrical impulse which produces a fluorescent sine wave on the oscillograph screen formed by the end of the cathode-ray tube. The amplitude of the wave crest and its position on the scale enable the operator to determine the amount and the angular position of the weight that must be removed from the rotor to bring it into exact dynamic balance. When this determination has been made, the rotor is brought to a stop and the bracket on which it is pivoted is swung backward out of the test position. Avey drilling machine heads located at both sides are used to drill out the required amount of metal at the proper angular position of the rotor.

The heading illustration on page 173 shows several gyro-compasses being subjected to a swing test. This is a preliminary test which permits the operator to observe the functioning of the compass and to make minor initial adjustments if necessary.

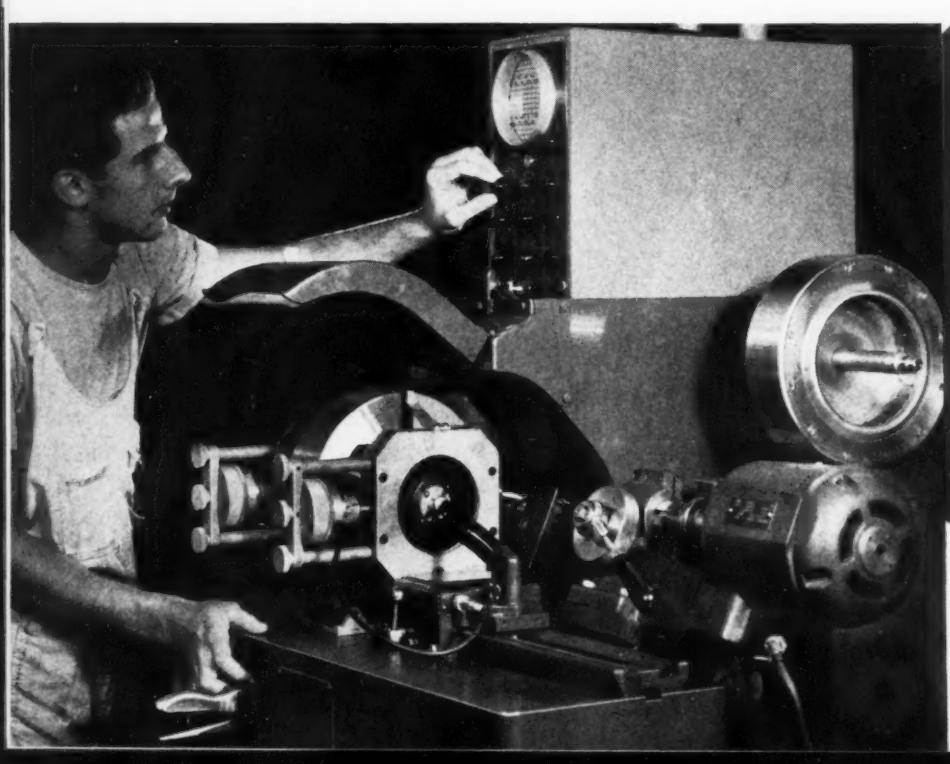


Fig. 9. (Above Left) Arrangement for Tinning and Assembling a Repeater Base and Column

Fig. 10. (Left) Testing Rotor in Cathode-ray Oscillograph Balancing Machine. Recess into which Stator Field is Inserted can be Seen in Rotor at Right

Building and Maintaining the Greatest Navy in History

(Continued from page 139)

production-line construction could be realized. It was necessary for important changes to be squeezed into production lines as unobtrusively as possible. Vast improvements in industrial knowledge and products were being realized under the impetus of war. In the design of a warship, a compromise between space and weight requirements for speed, protection, and armament must be struck. Whenever improvements in any of these could be incorporated in construction at a saving of weight and space, the "payload" or offensive power could be increased accordingly. Although there was no over-all saving in weight, there has been a vast improvement in the effectiveness of its use.

The goals set up by the President and believed by so many to be impossible of accomplishment have been met or exceeded. Men and women from all walks of life and from every town and city in the country have flocked to shipbuilding and repair centers. Living conditions were at times almost unbearable and the unaccustomed work tiring, but the majority stayed and made possible the situation as it is today. Women have contributed in large measure to the program. They are daily taking on new work in shipyards or replacing men leaving to join the Armed Forces.

In spite of freezing the design of ships to a large extent, improvements are finding their way into the final product at an astounding rate. This is brought about in many ways. The National Defense Research Committee and many other Government agencies are contributing to a marked degree. The workers themselves are thinking of better and faster ways of accomplishing the desired ends. Although, in most cases, the worker submits his ideas with the sole objective of improving the war effort, monetary rewards and suitable recognition of merit are made. It appears to those whose task it is to weed out the practical from the impractical, that the nation has turned into a land of inventors, so enthusiastic are those engaged in shipbuilding in their efforts to contribute.

The most impressive and the most satisfying statistics as regards shipbuilding are the reduction in man-hours required to turn out a ship of a given class, although the ships themselves are increasingly complicated. This reduction has been in round figures, 30 per cent since our entry into the war. This has been brought about by various causes, but the primary one is the effort, enthusiasm, and the "will to win" of the workers.

Building periods have been shortened greatly through the increased experience and knowledge of the personnel, improvements in methods, and the number of personnel actually working at the task. As examples of the improvements in building periods of ships realized since our entry into the war, the following are given:

Type	Building Period Reduced, Per Cent
Heavy Cruisers	41
Light Cruisers	29
Large Aircraft Carriers	47
Destroyers	69
Submarines	49

An impressive comparison is that of the main propulsion horsepower installed in completed combatant ships on December 7, 1941, and at present.

On December 7, 1941, about 13,000,000 H.P.

On September 1, 1943, about 32,000,000 H.P.

The contributions and the efforts of the millions engaged in this mighty effort to defeat our enemies in the shortest possible time and at the cost of as few lives as will suffice are not lost to posterity. The improvements in methods, the more effective employment of materials, the substitution of one material for another as one becomes more critical is knowledge gained which can be applied to a better way of life when the task on hand is accomplished.

* * *

Labor's Responsibility to Men at Front

In referring to a strike for a trivial cause at a large aircraft plant, the War Labor Board said in a telegram to local union officials: "It is not asking too much in time of war for labor on the home front to forego strike action even in the face of provocation, in order to guarantee continuous production needed for the support of our Armed Forces. You and the members of your union have no right to place your alleged labor grievances above the needs and welfare of our Armed Forces and the people of this country, especially in view of the fact that the orderly procedures of the War Labor Board have been provided you for a hearing of your grievances on their merits."

Editorial Comment

What has made the United States the leading industrial nation in the world? What has made possible the development of our great industries, employing millions of people at wages higher than anywhere else in the world? What are the main reasons for our standard of living, which has been raised to such a level that a larger proportion of the people live in comfortable homes than is the case in any other country in the world—a standard of living that, to mention but one of its manifestations, supports an automobile for every five people in the country, to say nothing about radios and telephones or washing machines and other labor-saving home appliances?

Someone might say that these achievements have been accomplished because of our great natural resources. That is true, but it is only part of the truth. Russia has great natural resources—as great as those of the United States if not greater; yet the standard of living in Russia has been notoriously low. China, too, has great natural resources. Hence, natural resources alone do not furnish an adequate explanation.

Free Enterprise has Built the America Men Fight for

The answer, however, is perfectly evident to everybody with an open mind: The free and untrammeled scope given to initiative on this continent almost since its earliest days. It is this that made ours a great industrial nation. The spirit of enterprise and the encouragement that freedom from artificial restrictions gives to the free enterprise system—these are the reasons why the United States has made such astounding progress during a comparatively brief span of years. To continue on the road of progress, initiative and enterprise must be encouraged, not stifled.

During recent years, we have made many departures from the principles on which this nation was founded. More and more the Government has assumed the right to prescribe for the individual what he shall and shall not do, taking away from him the freedom of decision. The Federal Government has usurped the rights of the states, and, in so doing, in many instances the rights of free enterprise.

How could the Federal Government do this? Only because the American people, all the way from the managers of industrial enterprises to the workers in mill and factory and on the farm, have permitted their individual rights to be abrogated without protests sufficiently loud to prevent this usurpation of power. If the men and women of today were as jealous of their individual rights as the early founders of this nation, these encroachments on individual liberty could not have become an accomplished fact.

Industry Must Insist on Less Interference by Government

Whether we shall remain a great industrial nation, whether we shall be able to maintain a high standard of living, whether we shall have freedom of action, or whether we are to be bossed by the bureaucracies of a central government in Washington depends upon the American people. Do we believe in free enterprise or would we rather have the Government be the chief employer, dictating to industry and to workers? Do American workers believe that men inexperienced in industrial management and in the conduct of great enterprises are better leaders to which to entrust the guidance of industry than the men who made our great industrial advance possible?

Shall We or Shall We Not Remain a Great Industrial Nation?

Whether, after the war, we shall have free enterprise or governmental dictation and interference in industrial management is a question to which a definite answer cannot now be given. It is certain that the answer will not be favorable unless the men at the head of American industrial enterprises display courage and stamina in voicing protests against interference with the free enterprise system and in combating, as far as they can, the present tendencies toward governmental socialism.

Machine Tool Builders Meet in Chicago

THE forty-second annual meeting of the National Machine Tool Builders' Association, held in Chicago October 11 and 12, was attended by over four hundred members and guests, the largest attendance in the history of the Association. The urgent current problems of the machine tool builders occupied all the sessions, including renegotiation, the termination of contracts, sub-contracting, and the post-war outlook for the industry.

James Y. Scott, New President of the National Machine Tool Builders' Association

Chief among the addresses made before the meeting were: "The New Outlook for the Machine Tool Industry," by Walter W. Tangeman, president of the Association and vice-president of the Cincinnati Milling Machine Co.; "Government Relations," by Ralph E. Flanders, chairman of the Association's Committee on Government Relations and president of the Jones & Lamson Machine Co.; "Machine Tool Builders as Sub-Contractors," by John B. Campbell, Director of Production Resources Division, War Production Board; "Termination of Contracts, New Style," by Tell Berna, general manager of the Association; "The Tools Division," by John S. Chafee, director of the Tools Division, War Production Board; "Post-War Plans," by Frederick V. Geier, member of the Association's Committee on Post-War Planning and president of the Cincinnati Milling Machine Co.; and "Australia Close-Up," by Fred W. McIntyre, vice-president of the Reed-Prentice Corporation.

In his address on the outlook for the industry, Mr. Tangeman pointed out that the machine tool industry has a well earned right to take a large share of the credit for retooling America in time. "But strange as it may seem," said the speaker, "the fact that the industry did this job so well contributes largely to the difficult situation in which it finds itself today. The machine tool emergency, in the nature of things, occurred ahead of the production emergency in other industries. The machine tool industry had to equip plants before guns and planes and tanks could roll off the production lines. The machines already built will go on producing for the emergency and for years thereafter, whereas the machine tool manufacturers now find the major portion of their production job accomplished.

"Even though the requirements for war materiel change, the machines built are universal enough to move from service to service. New projects will, of course, arise for which new tools will have to be provided. The man-power situation, critical as it is, should call for the installation of a number of new labor-saving tools. Some of the old tools with which we went into the war must be replaced, and our Allies still need a large amount of our product.

"However, on the basis of present estimates, the machine tool output needed for 1944 will represent only about one-fourth of the peak capacity built up by the industry."

In his address on the termination of contracts, Tell Berna pointed out that this is one of the most serious of the problems facing the Government and industry. The Armed Services have already been working on it in connection with the reductions in some war programs. However, the amounts involved are small compared with those that will be involved when the fighting stops and a total of some $75,000,000,000 in contracts must be cancelled and adjusted. Experience has proved the need of a far simpler procedure. All of the Armed Services are now reviewing their cancellation procedure. Mr. Berna briefly covered the present status of the cancellation procedure and the proposed changes.

The officers elected for the coming year are: President, J. Y. Scott, president, Van Norman Co.; first vice-president, Joseph L. Trecker, executive vice-president, Kearney & Trecker Corporation; second vice-president, W. P. Kirk, vice-president and sales manager, Pratt & Whitney Division Niles-Bement-Pond Co.; and treasurer, E. Blakeney Gleason, vice-president and treasurer, Gleason Works.

The following new directors were elected: W. P. Kirk, vice-president and sales manager, Pratt & Whitney Division Niles-Bement-Pond Co.; C. N. Kirkpatrick, president and general manager, Landis Machine Co.; R. E. LeBlond, president, R. K. LeBlond Machine Tool Co.

Effect of Tooth Clearance on Milling Cutter Performance

By S. C. BLISS

BREAKAGE of milling cutter teeth is sometimes caused by lack of adequate clearance for the lands on the cutting teeth. Too small a clearance angle and too wide a land, combined with too fast a feed relative to the cutter speed, may also cause "work-hardening" of the piece being milled. The latter effect is often responsible for the erroneous assertion that there are hard spots in the material, whereas the hard spots have actually been produced by the cold-working action of the improperly ground cutter.

The reason for cutter-tooth breakage, as well as the work-hardening effect on the material being milled, will be better understood by referring to Fig. 1. During the time that the face of the tooth moves from *A* to *C*, the work is fed from *A* to *B*, which is equivalent to the distance *F*. The shaded area *ABC* indicates the interference of the work with a tooth that has no radial clearance on its land. The metal represented by this shaded area must, obviously, be ironed back into the work and squeezed out at the sides of the cutter. This cold-working or flowing of the metal results in work-hardening of the milled surface. Interference such as indicated in Fig. 1 may be the cause of excessive vibration and chatter, and it may even stall the machine or break the cutter.

A typical effect of interference of the work and cutter-tooth land in milling certain metals is shown in Fig. 2. The pressure of the work against the tooth lands serves to "squirt" the metal out at each side of the cut at right angles to the direction of the feed, thus forming the burrs or fins shown at *D* and *E*. Another effect is to iron out a heavy burr at the edge where the cutter enters the work.

An indication that interference is the cause of milling cutter breakage may be found in the appearance of the tooth faces of the broken cutter. The spalling off on the faces of the teeth,

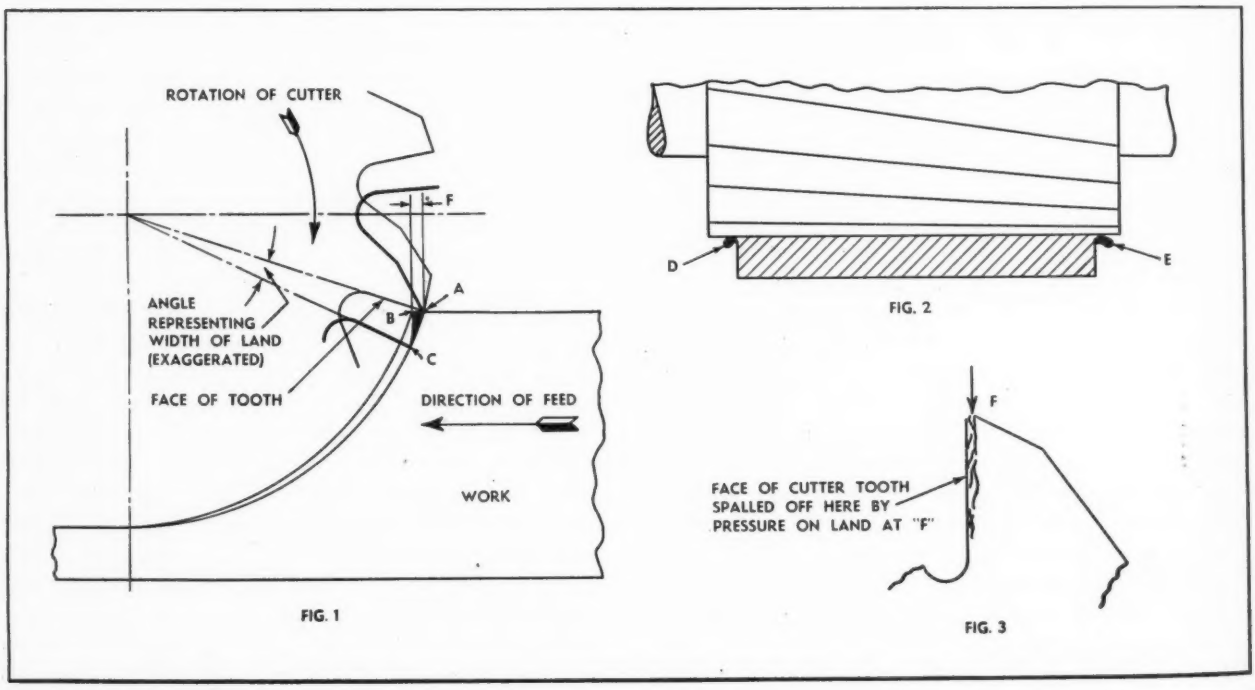


Fig. 1. Diagram Showing how Cutter Lands without Radial Clearance Angle Interfere with Work, as Indicated by Shaded Area ABC, Causing Work-hardening, Cutter Breakage, and Other Difficulties. Fig. 2. Diagram Showing Burrs or Fins D and E Caused by Interference of Cutter-tooth Lands with Work. Fig. 3. Cutter-tooth Breakage Resulting from Inadequate Clearance on Land

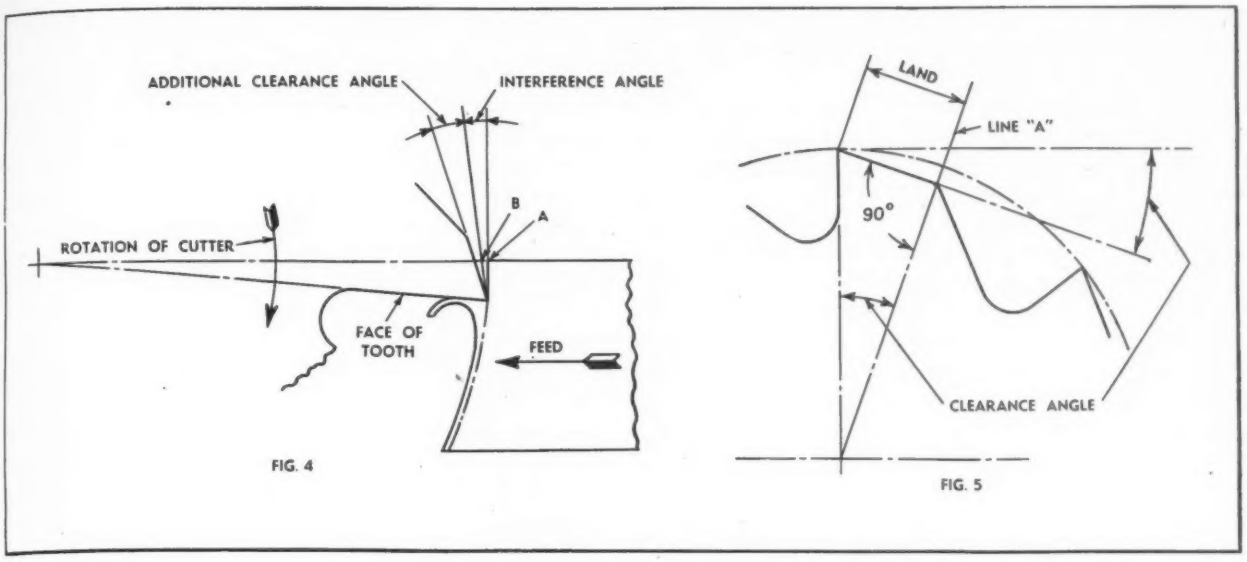


Fig. 4. Diagram Illustrating Method of Calculating Proper Clearance Angle for Lands of Milling Cutter Teeth. Fig. 5. Diagram Showing Relation of Clearance Angle to Width of Land on a Milling Cutter Tooth

as indicated in Fig. 3, shows definitely that the breakage is due to pressure on the *ends* of the teeth in the direction indicated by the arrow at *F*, and not by pressure against the tooth faces.

The method of calculating the clearance angle for the lands of milling cutter teeth to avoid the difficulties here discussed is illustrated in Fig. 4. Although this illustration shows a climb or "down" milling action, the same principles and method can be applied to conventional or "up" milling.

The tangent of the maximum interference angle is taken as equal to the feed, in inches per minute, divided by the peripheral or cutting speed of the cutter, in inches per minute. For example, the interference angle for a feed of 15 inches per minute and a speed of 75 feet, or 900 inches, per minute is calculated as 58 minutes. The additional clearance angle should be approximately 2 degrees.

The relation between the clearance angle and the width of land is an important consideration. Referring to Fig. 5, it will be noted that if the land extends beyond the line *A*, chips are likely to become wedged between the land on the tooth and the work-piece, and the clearance between the cutter and the work will be reduced. The width of the land as indicated in Fig. 5 is equal to the radius of the cutter multiplied by the sine of the clearance angle. The widths of lands for cutters ranging from 1/8 inch to 2.5 inches in diameter, with various clearance angles for the lands, as calculated by this formula, are given in the accompanying table.

It will be noted that the formula referred to does not take into consideration the feed of the work toward the cutter, and the consequent reduction in clearance between the work and the land on the cutter. An easily remembered method for determining the width of land, such as shown

Calculated Widths of Lands for Milling Cutter Teeth, Inches*

Diameter of Cutter, Inches	Clearance Angle on Lands, Degrees								
	3	4	5	6	7	8	10	12	14
1/8	0.003	0.004	0.005	0.006	0.007	0.008	0.010	0.013	0.015
1/4	0.006	0.008	0.010	0.013	0.015	0.017	0.021	0.026	0.030
3/8	0.009	0.013	0.016	0.019	0.022	0.026	0.032	0.039	0.045
1/2	0.013	0.017	0.021	0.026	0.030	0.034	0.043	0.052	0.060
5/8	0.016	0.021	0.027	0.032	0.038	0.043	0.054	0.065	
3/4	0.019	0.026	0.032	0.039	0.045	0.052	0.065		
7/8	0.022	0.030	0.038	0.045	0.053	0.060			
1.00	0.026	0.035	0.043	0.052	0.061				
1.5	0.039	0.052	0.065						
2.0	0.052	0.069							
2.5	0.065								

*Diagram shown in Fig. 5 indicates land width as given in table. Since the calculated widths do not make any allowance for feed of work toward cutter, the widths of land should preferably be less than those given in the table.

in Fig. 5, is to multiply the diameter of the cutter in inches by the clearance angle in degrees by 0.008.

Some years ago, the writer experienced trouble from excessive breakage of slab milling cutters. These cutters had steep spiral angle teeth, and were being used for climb or "down" milling operations. The clearance on the lands of the cutter teeth was 2 degrees. The interference angle, calculated according to the method shown in Fig. 4, was found to be 2 1/4 degrees. Increasing the clearance angle on the lands of these cutters to 3 degrees eliminated the excessive breakage of several hundred dollars' worth of cutters each week.

A common complaint from shops performing milling operations on the so-called "modified" S A E 1050 steel was that it had hard spots. An investigation of a number of these complaints showed that the trouble was caused by incorrect clearance on the milling cutter teeth. In no case was any hard spot found in the material as delivered to the milling machine. This material appeared to work-harden easily. It had a tendency to "pressure-weld" to the cutting edge of the tool, and thus form a false or built-up cutting edge.

It was found that the principal cause of trouble, when milling this material, was due to the use of milling cutters having circular lands without radial relief on the ends of the cutting teeth. These lands were the result of the practice of spinning the cutter on centers in the tool grinding department instead of grinding them with the proper relief. The inadequate relief of these cutter teeth resulted in the conditions described in connection with Fig. 1.

In one case, where the vibration and chatter of the milling machine was exceptional, calculations showed that the distance *A* to *B*, as indicated in Fig. 1, was less than 0.00002 inch; yet this small interference was sufficient to stall the machine. The milled side of the work showed a Brinell hardness about 60 points higher than the opposite surface directly under the cut. This difference in hardness was caused by work-hardening due to the ironing of material back into the work through the interference of the inadequately relieved cutter teeth, and to some extent by the sudden quenching (by the coolant) of the work, whose surface temperature had been raised by the ironing action.

* * *

Revised Code for Abrasive Wheels

The American Standards Association, 29 W. 39th St., New York 18, N. Y., has published an important revision of the Abrasive Wheel Safety Code. Copies of the revised code can be obtained from the Association at 35 cents per copy.

Recent Army-Navy "E" Awards

The following companies and their employes in the machine-building and allied fields have recently received either the Army-Navy "E" Award for high achievement in war production or a star to add to their Army-Navy "E" pennant for continued high production.

American Car & Foundry Co. Shipyard (third award).

Briggs Clarifier Co., Washington, D. C.

Carboloy Company, Inc., Detroit, Mich.

Craftsweld Equipment Corporation, Long Island City, N. Y.

Eastern Rolling Mill Co., Baltimore, Md.

Edwards & Co., Norwalk, Conn. (renewal).

Farrel-Birmingham Co., Ansonia, Conn. (third renewal).

Lodge & Shipley Machine Tool Co., Cincinnati, Ohio (third renewal).

George D. Roper Corporation, Rockford, Ill. (renewal).

Westinghouse Electric & Mfg. Co. (nine plants).

* * *

Three Million Federal Employes are Paid by Taxpayers

When the United States was suddenly faced with the problem of converting from peacetime to war equipment production, it became necessary to quickly hire a large number of men to be located in Washington and elsewhere, for the purpose of handling the administrative work suddenly forced upon the Government. Unfortunately, now that industry is quite capable of carrying on without a great deal of assistance from Washington, these men are still retained to perform work that industry can do equally well, or better.

Not only are many men retained whose services could be dispensed with, but from time to time the Government is adding more employes for work that industry is well able to handle without assistance. In fact, in many cases, according to industrial managers, these Government employes are a hindrance rather than an aid to production. They interfere with the active productive work of executives in industrial plants.

The Government now employs over 3,000,000 people, apart from the Armed Forces. That is approximately one Government employe for every nineteen people employed in all the useful occupations of the country—in industry, farming, transportation, distribution, marketing, retailing, etc. From now on the Government, if headed by men of efficiency, willing to save the taxpayer's money, should make it its business to reduce this unwieldy federal payroll.

Gear Manufacturers Continue Standardization Activities

At the twenty-sixth semi-annual meeting of the American Gear Manufacturers Association, held at Chicago October 25 to 27, emphasis was again placed on the Association's standardization activities. Much of the time of the members present was given to technical committee meetings, concentrated on various phases of gear standardization. Outstanding among the technical reports was one on "Gearmotors," prepared by the Gearmotor and Speed Reducer Sub-Committee, and presented by C. B. Connell, of the Westinghouse Electric & Mfg. Co., who is chairman of the committee. This report, in effect a treatise on gearmotors, is unusually comprehensive. It gives the engineer concerned with motors and speed reducers the necessary data for their efficient application and will doubtless be widely used.

Russell C. Ball, President of the American Gear Manufacturers Association

The meeting was opened by a brief address by the president of the Association, Russell C. Ball, president of the Philadelphia Gear Works, Inc. At later sessions, several important technical papers were read. George P. Maurer, supervisor of gear precision of the Falk Corporation, gave an address on hobs, covering this subject in an exhaustive manner. Another address, by Mr. Dudley and Dr. Poritsky of the Gear Engineering Division of the General Electric Co., dealt with "Cutting and Hobbing Worms and Gears." This subject was also presented in a very thorough manner.

The immediate problems of the gearing industry received adequate attention. A panel discussion, in which the business leaders of the industry took part, dealt with "Industrial Relations, Labor, and Man-Power Problems." This created unusual interest on the part of the membership. A report by George H. McBride, of the Westinghouse Electric & Mfg. Co., on the relationship of the industry to the Government was especially timely. Mr. McBride is chairman of the Association's Committee on Government Regulations. Members of the War Production Board were present at this session and were asked for information relating to present problems.

Several addresses of general interest were made. Joe J. Custer, a United Press war correspondent who has spent some time in the Pacific war area, gave an interesting talk on various phases of the war in the Pacific. An equally interesting and significant address was delivered by Homer McKee, vice-president of Roche, Williams & Cunnyngham, Inc., who spoke on "Where Business and the Individual are Going after this War." His address pointed to the dangers this nation is facing from within, and made it clear that winning the war is only part of the job of the American people if we are to preserve the traditional American freedoms (of which there are more than four, and of which freedom of individual enterprise is not the least).

All in all, the meeting was a very successful one, both from the engineering and the general point of view.

* * *

Machine Tool Production and Orders

According to information obtained from the War Production Board, shipments of machine tools for August—the last month for which complete statistics are available—totaled $87,827,000, a decline of approximately 10 per cent in value from the July shipments. Total net orders placed with the industry in August—that is new orders less cancellations—totaled $33,378,000, an increase of 16.2 per cent over July. The net new orders for August are equivalent to an annual rate of business of approximately $400,000,000. The backlog of accumulated orders at the end of August totaled $387,000,000. At the August rate of shipments, this backlog would be completed in about four and a half months.

* * *

The total economic costs of occupational accidents, including direct and indirect expenses, were approximately $2,300,000,000 in 1942.

A.S.M.E. Meets with Canadian Engineers

A JOINT meeting of the Engineering Institute of Canada and the American Society of Mechanical Engineers was held at Toronto, Canada, September 30 to October 2. The program covered topics intimately connected with the war effort and war equipment manufacturing. A wide range of subjects were dealt with.

One session was concerned with steam power, covering changes in steam generation principles, particularly for marine purposes, that have been brought about by the war. The effect on post-war power generation was also referred to. Another session concerned itself with a broad treatment of railway problems and the developments in railroad and air transport equipment inaugurated during the war; reference to their adaptation to peacetime transportation was made.

Important sessions dealing specifically with production engineering, the conservation of materials, man-power utilization, and quality control were held. In the production engineering session, the subjects discussed were comparative results obtained by riveting, casting, and welding of tank hulls; plastic plywoods in aircraft construction; and design features of the Mosquito airplane.

An important session on post-war planning reviewed what is being done to prepare industry for peacetime problems. Ralph E. Flanders, past-president of the American Society of Mechanical Engineers, and president of the Jones & Lamson Machine Co., spoke on "The Engineer as Planner"; W. A. Mackintosh, special assistant to the Deputy Minister of Finance of Canada, spoke on "International Aspects of Post-War Problems"; and W. S. Woods, Associate Deputy Minister of Pensions and National Health of Canada, discussed the subject of "Post-War Planning for Jobs."

Not the least important of the features of the meeting were the round-table conferences at which specific subjects pertaining to war production were discussed. These sessions dealt with metal-cutting tools, the use of modern steels in heavy industry, shell forgings, plastics, powder metallurgy, fuel substitutes, and synthetic rubber. The round-table conferences were unusually well attended. Their informal character made it possible for those present to obtain detailed information regarding the experiences of others attending the conferences on the subjects being discussed.

National Metal Congress Concentrates on War Work

THE National Metal Congress and War Conference Displays held at the Palmer House, Chicago, October 18 to 22, attracted a large number of engineers and manufacturing executives to the various sessions. The American Society for Metals held three simultaneous sessions each forenoon, with the exception of Wednesday, October 20, when the annual meeting of the Society was held, followed by the Campbell Memorial Lecture presented by C. H. Mathewson, Professor of Metallurgy, Yale University. In addition, each forenoon at 11:30, there were sessions addressed by outstanding men in the Army and Navy and War Production Board.

The afternoon sessions were devoted specifically to war production, at which important problems facing manufacturers were discussed. This program had been based on suggestions received from 1200 members of the Society. The theme of the war production sessions was increased production, conservation of materials, and post-war conditions.

At the morning sessions, there were thirty-six papers presented on practically every phase of the heat-treatment of steel, as well as papers relating to non-ferrous metals.

Simultaneously with the sessions held by the American Society for Metals, the American Welding Society held its twenty-fourth annual meeting at the Hotel Morrison. At these sessions, sixty-five papers were presented on the various phases of welding.

The Wire Association, with headquarters at the LaSalle Hotel, held six technical sessions, at which eleven papers were presented. The Metals Division of the American Institute of Mining and Metallurgical Engineers held a meeting at the Hotel Sherman simultaneously with the other meetings, where numerous papers relating to iron and steel and non-ferrous metals were presented.

The entire seventh, eighth, and ninth floors of the Palmer House were devoted to exhibits by various metal manufacturers, producers, and fabricators of materials and equipment. There were no installations of heavy equipment, such as displayed at previous exhibitions sponsored by the American Society for Metals. The exhibits consisted chiefly of light equipment, drawings, diagrams, charts, and other items suitable for display in the quarters in which they were exhibited.

Tool Engineers Stress War Production Methods

THE American Society of Tool Engineers held its eleventh semi-annual meeting at Indianapolis October 11 and 12. All the sessions were devoted to war production problems, except the address at the semi-annual dinner, which discussed post-war planning.

The problem of breaking in inexperienced men and women in the operation of machine tools formed the subject for an entire afternoon's session. In the papers and discussion, the employment of an increasing number of women was particularly emphasized. Machine tools in the past have been designed largely to be operated by men — and men with considerable training. Now women, practically without training, are expected to operate these machines.

Among the solutions for making machines more nearly automatic in operation, and therefore easier to run, were mentioned the application of pneumatic and hydraulic devices, not only in the design of the machines themselves, but in the operation of jigs and fixtures. Two papers were presented at this session, one by John Cotner, president of Logansport Machine, Inc., entitled "The Application of Pneumatic Devices to Machines," and one by L. R. Twyman, manager of the Machinery Products Division of Vickers, Inc., on "Hydraulics in Machine Tool Control and Fixture Operation."

One of the technical sessions was devoted to a discussion of gearing. At this session, Charles G. Pfeffer, production engineer of the Wright Aeronautical Corporation, read a paper on "Aircraft Engine Gears—Design and Production," while W. P. Schmitter, chief engineer of the Falk Corporation, read a paper entitled "Heavy-Duty Gear Design, Manufacture and Application."

New techniques in the heat-treatment of steel occupied another session during the meeting. The papers presented at this session were "Sub-Zero Refrigeration for Austenitic Decomposition of High Alloy Steels," by G. B. Berlien, chief metallurgist of the Lindberg Steel Treating Co.; and "Tocco Process of Induction Heating and Its Contribution to the War Effort," by Dr. H. B. Osborn, Jr., of the Ohio Crankshaft Co., Cleveland, Ohio.

In recognition of the vital job being done by one of the Indianapolis industries—the Allison Division of General Motors—some of the major tooling accomplishments of this aircraft engine builder were brought to the attention of the tool engineers. The papers at this session dealt principally with gears and surface finishes, and were read by D. Gerdan, and Richard S. Kegg of the Allison Division.

Recent investigations have shown that there is a great waste of man-power in the handling of raw materials, as well as semi-finished and finished articles, in industrial plants. It has been stated that as much as 90 per cent of the labor in some manufacturing plants is consumed in materials handling, including loading and unloading. This important subject was covered at one of the sessions.

The papers read at this session of the meeting included: "Materials Handling Engineering," by Randolph W. Mallick of the Westinghouse Electric & Mfg. Co.; "Mobile Materials Handling Equipment," by Ezra W. Clark, vice-president of the Clark Tructractor Division of the Clark Equipment Co.; and "Fixed Types of Materials Handling Equipment," by C. S. Huntington, chief engineer, Link-Belt Co.

Machine Tool Distributors Consider Post-War Problems

THE American Machine Tool Distributors' Association met Thursday and Friday, October 14 and 15, at the Seigniory Club, Montebello, Quebec, Canada. A great many of the problems now facing the builders and distributors of machine tools were discussed at this meeting.

At one of the sessions, Thomas Arnold, Machine Tool Controller for the Dominion of Canada, spoke on "The Canadian Machine Tool Situation." The subject of "Redistribution and Salvage of Machine Tools" was covered in addresses made by Brigadier General H. F. Safford and Colonel Haviland Wright, of the Redistribution and Salvage Section of the Office of the Chief of Ordnance of the United States. Some thoughts with reference to post-war conditions in the machine tool industry were expressed by N. P. Lloyd of Lloyd Machine Tools, Inc., Philadelphia, Pa. "The Washington Situation" was covered by A. G. Bryant, chairman of the Association's Committee on Government Relations. Another important address was made by J. Roy Porter, chairman of the Post-War Committee of the Association, on the subject "Disposal of Surplus Machine Tools."

Other reports and discussions covered conditions of sale, arbitration, salesmen's compensation, and refusal of priorities by local war Production Board offices.

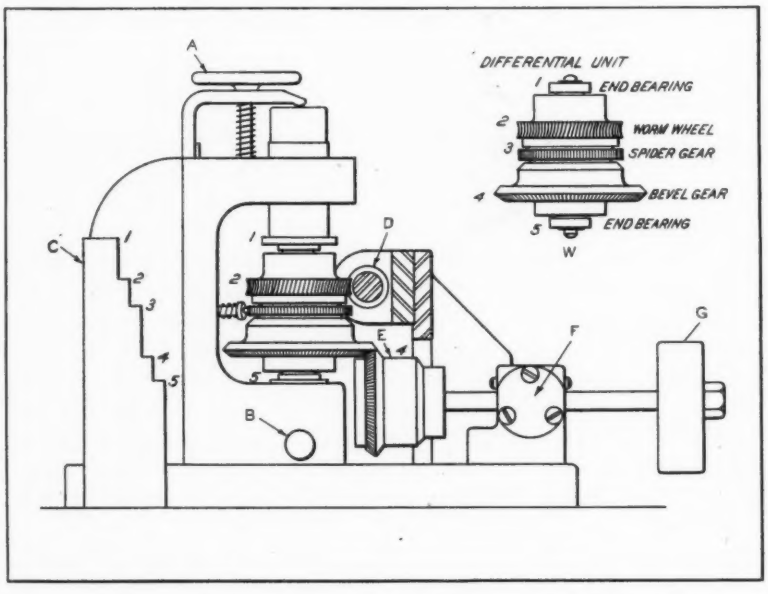
Checking Fixture for a Differential Unit

By G. J. STRAUB

The purpose of the fixture shown in the accompanying illustration is to check the differential unit *W* for correct dimensions between its three gears and the end ball bearings, and to check the bevel gear and worm-wheel for run-out. Variations from the gage at the five positions designated by the numerals 1 to 5 are noted on a card which remains with each unit.

The fixture and gage *C* are fastened with screws to a surface plate, about 15 by 18 inches. The master worm *D*, in its carrier, is free to slide on the surface plate and against one machined side of the base of the fixture. Bevel-gear holder *E* rotates on its shaft and oscillates vertically about center *F*. Ball bearings facilitate these movements. The two bevel gears are held in mesh by counterweight *G*. Heights are compared by means of an indicator reading to 0.0001 inch, which is mounted on a surface gage.

The differential unit is placed in the frame of the fixture, which holds the end bearings in upper and lower plunger units. The plungers and differential are adjusted vertically as a unit by screws *A* and *B* until the top face of the worm-wheel lines up with Step No. 2 on gage-block *C*. This locates the differential roughly. For accurate location, the master worm *D* is blued, moved into position against the worm-wheel, and rotated. Further adjustment, if needed, is made with screws *A* and *B* until the worm is accurately meshed with the worm-wheel. The worm-carrier is then slid back to facilitate the use of an indicator gage.



Fixture Designed for Checking Dimensions between Gears and Bearings of Differential Gear Unit

The indicator gage is set to the steps on gage *C* for checking the corresponding steps on the differential, and any variations are noted on a card. Run-out of the bevel gear and worm-wheel is checked and noted with the spider gear locked in different positions by a spring plunger. Dimension corrections are made by changing the size of the proper spacer inside the unit.

* * *

Changes in Tax Procedure that Would Encourage Post-War Activity

Changes in corporation taxes should be made with the objectives of encouraging efficient operation of industries and of providing adequate aid to business in making provision for post-war reconversion of war production plants to normal operations, for research, and for starting new enterprises.

There should be an allowable deduction from current net income for reconversion and rehabilitation reserves to be funded by the issuance of Federal non interest-bearing securities redeemable in cash during the post-war period for purposes of rehabilitation. This should be given consideration in the renegotiation of war contracts.

Neither corporate income tax rates nor excess profits rates should be increased. Present methods of calculating the excess profits tax should be revised. This tax should be entirely repealed at the end of the war.

There should be a complete abandonment at that time of corporate income taxes. Such taxes during the war should be limited, so as to maintain an incentive to economic production. The profits of industry should not be taxed twice, as they now are. Taxing corporations merely increases the costs of products or services at the expense of the purchasers.—*Stevenson, Jordan & Harrison.*

* * *

By plating airplane-engine piston-rings with a 0.005-inch thickness of chromium on the surface in contact with the cylinder, aircraft can fly five times as many hours between engine overhauls. The chromium plating of airplane-engine piston-rings is not the bright, hard plating used for decorative purposes; instead, it is known as "Porus-Krome," a plating that permits ample lubrication and yet has a remarkable resistance to wear.

Condensed Review of Some Recently Developed Materials—2

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Flux for Gas-welding Magnesium	**Mag-Na-Flo**	A flux that is mixed to a thin paste with water and is applied on the metal to be welded with a small brush or to the welding wire by dipping.	Suitable for gas-welding all alloys of magnesium, whether in sheet or extrusion form.
Fire Extinguisher	**Magout**	A non-absorbent, finely pulverized powder.	For smothering fires in magnesium shavings and magnesium incendiary bombs.
Anti-rust Oil	**Miccroil**	This oil contains 42.5 per cent total solids, and has a consistency that provides a uniform protective film. Is applied by hand-dipping, and removed with a solvent.	For protection of metal surfaces subject to corrosion.
Stop-off Lacquer	**Miccro-Supreme**	An easily applied lacquer that eliminates the handling and grinding operations ordinarily required before heat-treating to remove copper-plating on areas to be hardened.	Used in connection with localized hardening of steel parts. Prevents copper-plating from adhering to areas to be hardened.
Protective Wrapper	**No-Ox-Idized Wrapper**	A tough, moisture-proof wrapping material made of cellophane film, laminated to a light cotton fabric and impregnated with moisture-proof materials.	Developed to save time usually required for cleaning off grease or other rust preventive compounds from products after delivery. Can be sealed by twisting ends of package or by a heat sealing device.
Weld Spatter Material	**No-Spat**	A liquid that prevents the adhesion of welding spatter.	Is brushed over the seam and area where weld spatter is likely to fall.
Anodic Degreasing Material	**Oakite Composition No. 90**	A cleaning agent with high conductivity, ready adaptability to hard water conditions, effective smut removing properties, and fast wetting-out action. Particularly effective where large volume of work is handled and fast soil removal is essential.	Intended for anodic degreasing of cold-rolled steel parts before finishing. Has been found advantageous in plating departments and contract finishing shops using Bullard-Dunn process for coating steel.
Blackout Paint	**P-40**	A blackout paint that dries in thirty to forty minutes to a self-leveling, dull, flat surface.	Suitable for outdoor applications. Unaffected by exposure to sunlight, rain, sleet, snow or exhaust steam.
Refractory	**Plicast L-W-1**	A light-weight insulating refractory that can be cast. Thermal conductivity less than 30 per cent that of ordinary firebrick. For service temperatures up to 2200 degrees F. Weighs only 50 pounds per cubic foot after drying. Supplied in dry powder form, ready for mixing with water.	Within its temperature range suitable for use as refractory lining in heat-treating, annealing, stress-relieving, and carburizing furnaces; burner blocks in boilers; ducts and breechings; water walls.
Impregnated Plywood	**Pluswood**	A resin-impregnated plywood having a specific gravity of 1.3 to 1.4, tensile strength of 32,000 to 40,000 pounds per square inch, compressive strength up to 40,000 pounds per square inch, and impact strength (Izod) of 6 to 8 pounds per inch of notch.	For structural applications and, where conditions permit, for use as a metal substitute. It can be sawed, drilled, turned, threaded, milled, and tapped with metal-working tools.

Review of Some Recently Developed Materials— Continued

Class of Material	Trade Name	Properties	Applications
Protective Compound for Hands	**Ply-Rustex**	Forms a protective coating that is inert with respect to oils, cutting compounds, and other materials encountered in industrial processes. It is non-toxic and harmless to the skin.	For use on hands to prevent perspiration corrosion of highly polished surfaces when handled.
Bronze Hardener	**P-M-G Hardener**	A hardener used as a substitute for tin in bronze castings.	Suitable for use in bronze castings having tin content of 8 to 10 per cent, where savings in tin are needed.
Water Absorbing Oil	**Polar R**	A light oil having the property of removing perspiration, water, oil, and dirt from iron or steel surfaces. Is completely soluble in hydrocarbons and lubricating oils.	Intended for dehydrating and cleaning steel surfaces, bearings, or similar parts that have become wet. Especially applicable for protection of water side of steam turbines, water pumps, and meters in storage.
Corrosion Protective Compound	**Pore-Pac**	A treatment for protecting castings, in which casting is immersed in a solution of gums at about 350 degrees F. This is followed by heating to 200 degrees F. in an oven.	Castings are protected against corrosion and penetration by oils at temperatures under 150 degrees F.
Powdered Metal	**Porex**	A porous powdered metal product available in the form of disks, sheets, cylinders, truncated cones, and special shapes. Can be bonded to steel and copper and then, as an integral part of solid metal, is readily machined, ground, bored, or threaded.	Used as filter for such fluids as oil; to alter characteristics of gases by diffusion, reducing pressures and controlling flow rates. Applied in refrigeration systems, oil-burner systems, and paint spray equipment.
Babbitt Metal	**Power Nickel Genuine Babbitt**	Tensile strength, 17,500 pounds per square inch; yield point, 6500 pounds per square inch; and Brinell hardness, 27. Resistant to extreme local heat.	Adapted for heavy bearing loads, such as in railroad service, rolling-mill machinery, and paper-mill machinery.
Protective Hand Cream	**Pro-Tek**	A greaseless hand cream which forms an invisible film that protects the skin against contaminated oils and other irritating substances. Can be readily removed with soap and water.	Useful in plants where workers' hands are exposed to oil, grease, solvents, or paints.
Protective Coating for Finished Surfaces	**Protektol**	A transparent removable coating applied by spraying, brushing, dipping, or roller coating. One gallon covers about 250 square feet. Drying time at 200 degrees F., six to eight minutes.	Suitable for use on finished metal and ceramic surfaces to prevent product rejection due to rust, surface scratches, shop wear, grease, and dirt. Because coating is transparent, visual inspection of surface covered is possible.
Babbitt Substitute	**Pyramid**	A lead-base bearing metal suitable for use in place of tin-base babbitt.	Particularly suitable where bearings must withstand heavy sustained pressures, such as in marine reciprocating engines, water turbines, paper-mill calender stacks, and rolling-mill machinery.
Coolant	**Quaker A. M. Base No. 11**	A clear claret-colored oil, which can be mixed as a base with kerosene.	For use as a coolant in cutting operations on aluminum, zinc, magnesium, and their alloys.
Piercing Compound	**Quaker Piercing Compound No. 10**	This compound, when sprayed or swabbed on punches, prevents sticking, increases punch life, eliminates pitting, and insures clean work.	For use in hot-piercing of shell forgings or other similar products.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Solvent Cleaner	**Quaker Quasol No. 80**	A solvent that can be mixed with hot or cold water for removing grease, oil, and dirt from all types of metals.	Suitable for use in pressure type washing machines. Acts as a rust preventive.
Bonding Compound	**Reanite**	A compound that, when applied by brushing, spraying, or dipping to surfaces of like or different materials, results in an exceptionally strong bond after low heat and pressure are applied. Tests show metal-to-metal joint strength comparable to that of riveting or spot-welding.	For bonding metal to metal, rubber, plastics, leather, wood, or any of these materials to each other. It is being used for airplane sub-assemblies, motor mounts, and composite metallic and plastic units.
Protective Coating for Metals	**Resi Flex**	A coating said to be waterproof, oilproof, and impervious to mineral acids, alcohols, and gasoline. After application, the finish is baked on for 6 to 30 minutes at 275 to 300 degrees F.	Applied as a protective coating for metals by dipping, brushing, or spraying.
Low Tin-Content Babbitt	**Rex**	A low tin-content babbitt having a tensile strength of 8200 pounds per square inch; elongation, 1.2 per cent in 2 inches; reduction in area, 1.8 per cent; compressive strength, 17,500 pounds per square inch; and pouring temperature, 625 to 675 degrees F.	Suitable as a substitute for high tin-content babbitts, necessitated by compliance with government tin conservation order M-43-a.
Fluid for Metal Marking	**Rives Metal Marker**	A fluid which provides a permanent marking that does not wash or rub off. Is applied with ordinary rubber stamp.	Original formula intended primarily for marking most ferrous metals and copper.
Brazing Flux	**Scaiflux 21**	A brazing flux with low melting point and low surface tension.	Suitable for brazing any type of ferrous or non-ferrous alloy.
Bearing Material	**Selflube**	Bearings made of powdered iron saturated with oil. Have an average porosity of 25 to 35 per cent. For many applications original oil supply is sufficient for entire bearing life	Interchangeable with bronze bearings in most applications.
Concrete Floor Cement	**Smooth-On No. 7B**	A wear-resistant iron-base cement that is dustproof, oilproof, and waterproof.	For filling cracks, ruts, and shallow holes in concrete floors.
Magnesium Fire Extinguisher	**Speedi-Out**	A hard coal tar pitch that is non-abrasive, non-corrosive, and non-toxic. Produced in a granular form with a 6/35 mesh that has a softening temperature exceeding 300 degrees F.	Intended for extinguishing magnesium fires and incendiary bombs. After the fire has been put out, the dry pitch can be readily chipped off.
Hard-facing Rod	**Stoodite K**	A cast hard-facing rod consisting principally of molybdenum, tungsten, manganese, silicon, carbon, and iron. Deposits average 54 to 58 on Rockwell C scale, and are smooth, dense, and free from porosity and shrinkage cracks.	Available in bare form for oxy-acetylene application, and in coated form for direct-current electric application. Suitable for hard-facing where considerable pressure, impact, or abrasive wear is experienced, such as in agricultural tools, cement-mill parts, brick and clay equipment, and dredging and excavating equipment.
Hard-facing Rod	**Stoody Self-Hardening K**	A hard-facing rod made in the form of tubes with mixed alloys of molybdenum, manganese, silicon, carbon, vanadium, and iron on the inside. Deposits average 50 to 54 on Rockwell C scale, and are highly resistant to wear and considerable impact.	Forms excellent bond with manganese steel. Deposits can be forged at red heat. Recommended for hard-facing tractor parts, crushers, conveyor buckets, dredge pump impellers, and other equipment subjected to severe wear.

Review of Some Recently Developed Materials— Continued

Class of Material	Trade Name	Properties	Applications
Hard-facing Alloys	Stoody 1 Stoody 6	Two hard-facing alloys of cobalt, chromium, and tungsten. Stoody 1 provides high resistance to abrasion, corrosion, and heat; Stoody 6 is much more ductile and provides greater resistance to impact.	Stoody 1 is recommended for hard-facing pump sleeves, wood-saw teeth, carbon scrapers, wire guides, expeller parts, etc. Stoody 6 is useful for hard-facing high-pressure, high-temperature valves, gasoline and Diesel engine exhaust valves, guides, shear blades, cams, etc.
Temperature Indicating Compound	Tempilaq	A temperature-indicating compound that dries immediately upon application and melts when a stated temperature is reached. Available in a range of compositions for indicating any temperature from 125 to 350 degrees F. in 25-degree intervals, and from 350 to 1600 degrees F. in 50-degree intervals.	Developed especially for use on polished surfaces, on the inside of tubes or castings, and on other inaccessible places, such as overhead surfaces
Heat-treating Process	Tuff-Hard	A method of heat-treating tools that enables them to remove a considerably increased amount of material per stroke or revolution.	For improved cutting ability of tool steels, particularly molybdenum high-speed steel.
Corrosion-Resistant Compound	Tygon	A synthetic compound resistant to practically all inorganic and organic acids, salt solutions, and alkalies. Unlike rubber, which it resembles in many characteristics, it is unaffected by oxidizing agents and many hydrocarbons. No heating, baking, or vulcanizing is required.	Available in three forms—patent-leather like material suitable as a lining for process equipment; a resilient compound that can be formed into flexible sheets, tubes, and molded goods; and a liquid that can be sprayed, dipped, or painted on surfaces subject to corrosion.
Conductive Belting	Uskon	Rubber belting that does not accumulate static electricity, ordinarily generated by friction on belting surfaces.	Applicable in locations where discharge of accumulated static electricity might produce fire or explosion. Useful also for carrying paper or cellophane which has a tendency ordinarily to adhere to statically charged belting.
Rubber Construction Material	U. S. Royal Insulation Board	Cellular rubber, consisting of thin external dense layer enclosing microscopic cells of nitrogen gas in a matrix of rubber. Heat transmission is 0.237 B.T.U. per hour per degree F. difference (12- by 12- by 1-inch specimen). This material is moisture-resistant; rot-proof; and oil-, acid-, and fire-resistant. It can be sawed and planed, and can also be shaped when heated.	For use as heat insulation material and also in supports for self-sealing airplane gas tanks.
Blackout Paint	Valdura Black-Out	A paint that can be sprayed or brushed on windows to prevent all passage of light. Has the advantage of being readily removable.	Suitable for blacking out windows and skylights of industrial plants.
Aluminum Paint Substitutes	Valdura Defense Grays	Two shades of gray paint having a high glossy finish and good resistance to rain, sun, grime, smoke, and oxidation.	Designed to provide metal surfaces with effective protection and long durability.
Aluminum Paint Substitute	Valdura Enamelized Yellow Metal Primer	Can be used under water when covered by one or two coats of Defense Gray. The light yellow color requires only a single coat of finishing paint to hide primed surface.	Designed for all types of metal surfaces, especially where exposed to extremely damp, wet, or foggy conditions.

Review of Some Recently Developed Materials— Continued*

Class of Material	Trade Name	Properties	Applications
Aluminum Paint Substitute	**Valdura Metal Lead**	The metallic lead in this paint provides a leafing action similar to that of aluminum, and affords a coating highly resistant to acids, alkalies, oxidation, and moisture. Will resist temperatures up to 225 degrees F.	Provides a protective metal coating for all metal surfaces, including new or old galvanized metal. Can be used as a general paint primer, except under paints containing asphalt.
Aluminum Paint Substitute	**Valdura Tank White**	This paint has a reflectivity factor 10 to 15 per cent higher than aluminum paints, and is resistant to oil and water.	As a substitute for aluminum paint where it is desirable to cut evaporation losses and reduce inside temperatures.
Plastic Resin	**Vinsol**	A resin powder which, when added to various cellulose fibers, provides a thermoplastic fibrous resin composition that is hard, dense, stiff, and has considerable toughness. It is of light weight and has low water absorption.	Suitable as a substitute for steel or other metals in food containers, automobile license plates, certain types of conduits, and cement-filled columns supporting light loads.
Synthetic Insulation	**Vinylite**	A synthetic material available in various forms as extrusion compounds or as a film compound supplied in the form of tape. It has superior aging properties, is highly resistant to normal weathering conditions, has low moisture absorption, and high dielectric and tensile strength. A special type remains flexible at temperatures down to minus 50 degrees F.	As extrusion compounds can be coated on wire or cable cores to form a uniform insulating wall of desired thickness. Can also be fabricated in the form of tubing for use as over-all jacket or duct. As tape, is used as an insulation wrapping.
Vinylite Resin	**Vinylite Resin VMCH**	This resin is characterized by improved adhesion to wide variety of surfaces, making possible formulation of air-dry or low-bake coatings possessing resistance to corrosive chemicals, moisture, and extreme weathering comparable to that shown by baked finishes based on Vinylite vinyl chloride-acetate resins.	Developed for use in corrosion-resistant finishes, such as air-dry coatings for maintenance work; coatings for industrial buildings and equipment exposed to corrosive atmospheres; coatings and linings for storage tanks to hold petroleum products, acids, chlorides, and similar corrosive materials; coatings to withstand prolonged water soaking or extreme weathering. Suitable for application over magnesium and aluminum alloys, particularly when subjected to salt-water immersion.
Silver Solder Flux	**XCel-Flux SS**	A silver solder flux that has a breaking point of approximately 920 degrees F. and becomes completely fluid at 1065 degrees F.	In use, it throws off a green transparent flame that does not obscure the work.
Phenolic Plastic	**XM-15000**	Has high impact strength and relatively good water resistance. Can be preformed on automatic tabletting machines.	Recommended for molded parts subject to temperatures up to 300 degrees F.

*This review of materials is continued from October MACHINERY.

Meehanite Iron in Shell Dies

For forging shells 5 inches and under for mobile guns, cast dies of Meehanite iron are used extensively in Great Britain, according to *Metals and Alloys*. One of the most interesting applications is in the severe operation of horizontal nose forging. The Meehanite used is "GA" (unalloyed); the forging temperature is 2100 degrees F. The die life, so far, has been 6000 forgings. Previously, steel was used for the dies.

In aerial bomb production, GM Meehanite piercing and nosing dies for forging 40-pound bombs produced 3500 forgings, as against 2500 with a nickel-molybdenum steel die. Another manufacturer, using the same type of Meehanite, obtained an average life of 20,000 forgings on 3.45-inch shells, with four remachinings, as against 12,000 forgings from nickel-chromium-molybdenum air-hardening steel dies.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 195 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the November Number of MACHINERY

Service Engineering

MERZ ENGINEERING CO., Indianapolis 7, Ind. Catalogue entitled "Four Spheres of Service to American Industry," descriptive of the design and research service offered by the company, as well as of the divisions devoted to the manufacture of gages and to the precision manufacture of metal parts and products on a volume basis. 1

Tantung Tools

VASCOLOY-RAMET CORPORATION, North Chicago, Ill. Tantung tool catalogue No. 227, covering the complete line of Tantung tools made by this concern, and containing information on how to grind and braze Tantung, together with performance data showing results obtained with Tantung in various machining operations. 2

Contour Sawing Machines

CONTINENTAL MACHINES, INC., 1312 S. Washington Ave., Minneapolis, 4, Minn. Catalogue entitled "DoAlls on Production—A Story in Pictures." Circular 1058 BD, descriptive of DoAll contour saws in metal dispensing containers. Circular D96, entitled "Sensational Contour Cutting with New Models." 3

Data on Cold-Finished Steel Bars

LASALLE STEEL CO., Chicago, Ill. Bulletin 1, descriptive of the process of making cold-finished and furnace-treated steel bars. Bulletin 2, entitled "Predicting Engineering Properties through Cold-Finishing Methods and the Jominy Test." 4

Industrial Lubricants and Metal Cleaners

SUN OIL CO., Philadelphia, Pa. Booklet entitled "What Makes a Grease?" describing the characteristics of Sun adhesive pressure greases and their application. Leaflet containing case histories of the cleaning up of war parts with Sun spirits. 5

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-4053, entitled "The Short Circuit—that Moves Mountains," describing the amplidyne, its applications and production gains obtained through its use. Bulletin GEA-3856, on the Cabinetrol, a standard system of centralized low-voltage control. 6

Turret Lathe Tool Engineering Data Book

INTERNATIONAL MACHINE TOOL CORPORATION, FOSTER DIVISION, Elkhart, Ind. Engineering Data Book covering standard and special tools for Foster 1F, 2F, 3F, and 4F Fastermatic turret lathes, and instructions for set-up men and tool engineers. 7

Spot-Facing and Counterboring Tools

NASH-ZEMPEL TOOL DIVISION of the J. M. NASH CO., 2354 N. 30th St., Milwaukee, Wis. Bulletin announcing a new spot-facing and counterboring tool designed so that the cutter can be quickly removed for sharpening. 8

Locking System for Threaded Inserts and Studs

BARDWELL & MCALISTER, INC., 7636 Santa Monica Blvd., Hollywood 28, Calif. Circular 1068, descriptive of the Rosan locking system for locking Rosan inserts and studs in metals, plastics, and wood. 9

Grinding and Finishing Equipment

MINNESOTA MINING & MFG. CO., St. Paul 6, Minn. Circular FBI 8543, entitled "Are You Interested in Grinding and Finishing?" descriptive of backstand idlers equipped with abrasive belts and segment-face contact wheels. 10

Welding Stainless Steels

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa. 64-page illustrated book containing information on the techniques commercially employed in welding stainless steels and the precautions to be observed in these operations. 11

Power Plant Maintenance

OAKITE PRODUCTS, INC., 22 Thames St., New York 6, N. Y. Digest describing sixty-five problems and jobs that commonly occur in power plant maintenance such as degreasing, paint stripping, rust removal, etc. 12

Metal Cleaning and Finishing Machinery

HOWARD ENGINEERING & MFG. CO., 1832 Freeman Ave., Cincinnati, Ohio. 32-page catalogue containing new data and applications covering metal cleaning and finishing machinery. 13

Copying Machines

HUNTER ELECTRO-COPYIST, INC., Syracuse, N. Y. Catalogue descriptive of the Hunter Electro-

Copyist, a machine adapted for rapidly copying all kinds of material such as drawn, printed, photographed, or typed copy. 14

Prevention of Welding and Cutting Fires

INTERNATIONAL ACETYLENE ASSOCIATION, 30 E. 42nd St., New York 17, N. Y. Booklet containing instructions for users of welding and cutting equipment on how to reduce potential fire losses. 15

Collet Chucking Fixture

WAYNE PUMP CO., Fort Wayne 4, Ind. Circular 750, descriptive of the Wayne universal collet chucking fixture, furnished with blank jaws which can be quickly adapted for holding any special or unusual shaped part. 16

Electronic Heaters

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Diamond Tools

WHEEL TRUEING TOOL CO., INC., Detroit 6, Mich. Second of a series of booklets illustrating and describing the complete line of diamond tools developed by this company. 18

Carbide Tools

WILLEY'S CARBIDE TOOL CO., 1340 W. Vernor Highway, Detroit 1, Mich. Bulletin 143, giving dimensions and prices of Willey's standard tungsten-carbide cutting tools and blanks. 19

Heat-Treating Atmospheres

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-3251, on four basic heat-treating atmospheres, covering composition, cost, application, and equipment needed. 20

Gear-Shaving Machines

FELLOWS GEAR SHAPER CO., Springfield, Vt. Circular describing the design and operation of the Fellows No. 4 fine-pitch gear-shaving machine for shaving external spur and helical gears. 21

Cutting Tools

MACHINISTS TOOL CO., 2834 Lake St., Chicago, Ill. 48-page Handbook on Matco milling cutters, reamers, and special formed tools, including data on design and selection. 22

Radial Tapping Machines

BAKEWELL MFG. CO., 2023 Santa Fe Ave., Los Angeles 21, Calif. Catalogue illustrating and describing the Bakewell 1-R precision radial tapping machine for production tapping. 23

Blast-Cleaning Equipment Operators' Manual

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Illustrated manual on the care and operation of Wheelabrator airless abrasive blast-cleaning equipment. 24

Quenching Steel

E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia, Pa. Treatise dealing with the quenching of steel, including data on quenching oils and advanced quenching practices. 25

Dial-Indicator Hole Gages

FEDERAL PRODUCTS CORPORATION, 1144 Eddy St., Providence, R. I. Instruction booklet for setting and using Federal Model 1201 series dial-indicator hole gages, available for users of these gages only. 26

Degreasing Steel and Copper

OAKITE PRODUCTS, INC., 26 Thames St., New York, 6, N. Y. Booklet describing a newly developed anodic cleaning material for degreasing steel and copper prior to plating and finishing. 27

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LESLIE WELDING CO., 2943 Carroll Ave., Chicago 12, Ill. Bulletin 9-43, descriptive of the Leslie self-balancing die set, which assures positive alignment of punches and dies without leader pins. 28

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equipment, including surface plates, work benches, lapping plates, checking tables, etc. 29

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DESIGNERS FOR INDUSTRY, INC., 2915 Detroit Ave., Cleveland 13, Ohio. Pamphlet entitled "Twelve Questions and Answers on D.F.I. Planned Products Service." 33

Aluminized Steel

AMERICAN ROLLING MILL CO., Middletown, Ohio. Booklet containing instructions relating to the use of aluminum-coated steel. 34

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CHAMPION DIAMOND CO., 551 Fifth Ave., New York 17, N. Y. Circular covering the various types of diamond tools made by this concern. 35

"Koolpore" Grinding Wheels

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass. Circular containing information on the design and performance of "Koolpore" grinding wheels. 36

Heavy-Duty Turret Lathes

INTERNATIONAL MACHINE TOOL CORPORATION, LIBBY DIVISION, Indianapolis, Ind. Catalogue covering the Libby Type H heavy-duty turret lathes. 37

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FAIRBANKS, MORSE & CO., 600 S. Michigan Ave., Chicago 5, Ill. Bulletin 3000A, entitled "Fairbanks Morse Diesels for Profitable Power." 38

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VINCO CORPORATION, 8853 Schaefer Highway, Detroit 27, Mich. Catalogue entitled "Millionths of an Inch for Sale by Vinco." 39

Hydraulic Elevating Table

LYON-RAYMOND CORPORATION, Greene, N. Y. Bulletin 133, descriptive of the Lyon hydraulic portable elevating table. 40

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MOORE SPECIAL TOOL CO., INC., 740 Union Ave., Bridgeport, Conn. Circular on the Lacey portable die-set machine. 41

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HYDRAULIC PRODUCTS CO., 525 W. 76th St., Chicago, Ill. Bulletin P-3, on hydraulic furnace pushers for use in the heat-treatment of billets, shells, and parts. 43

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YOUNGSTOWN MILLER CO., Sandusky, Ohio. Bulletin YM-600, on oil purifiers and reclaimers. 47

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Which of the new or improved equipment described on pages 206-226 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in November, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

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CHECK *RIGIDITY* OF CUTTER MOUNTING – for efficient milling on your No. 000's

Run the machine spindle sleeve forward as far as possible to permit locating the cutter close to the spindle nose

Further support the arbor by use of the Arbor Yoke close to the cutter

DELIVERIES ARE GOOD
on *New* No. 000 Plain Milling Machines

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
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Additional rigidity can be obtained by using the Hinged Arm Brace Arrangement

Make full use of the production possibilities of the No. 000 Plain Milling Machine for the rapid milling of small parts on a wide variety of materials.

BROWN & SHARPE

Tipping Worn High-Speed Steel Tools with Cemented Carbide

By CARL BLADE
Carboloy Company, Inc.

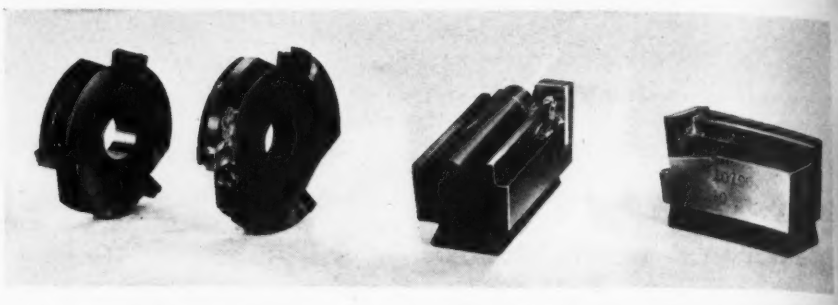


Fig. 1. (Left) Reclaimed Circular Form Tools. (Center and Right) Form Cutters with Carbide Tips Ready to be Ground to Form of Shank

ABOUT a year ago the Yale & Towne Mfg. Co., Stamford, Conn., began salvaging high-speed steel tools by renewing their cutting surfaces with cemented-carbide tips, applied by means of torch brazing. This practice is said to have proved so successful that the company is now applying cemented-carbide tips to new high-speed steel tools as well, thus increasing their life expectancy many times.

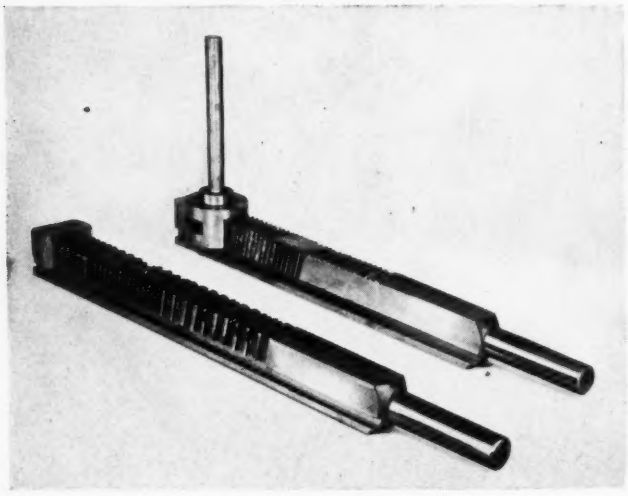


Fig. 2. Worn Broach Reclaimed as Shown at Left with Carbide Tips Applied by Brazing

The circular form tools shown at the left in Fig. 1 are typical of the reclaiming work done at the Yale & Towne plant. To reclaim these tools, standard carbide tips were cut in half with a diamond cut-off wheel, brazed to the tool face, and then ground to conform with the shape of the form tool body.

High-speed steel form cutters such as shown in the central position and at the right in Fig. 1 are renewed by brazing on standard carbide tips and grinding them to the form of the tool shank. Incidentally, the excess carbide from the oversize tip shown here is also salvaged and used for tipping smaller tools.

Rather an unusual salvaging job was done on the tool shown in Fig. 2. When the original high-speed steel broach shown at the right was worn out, every other tooth was removed and the balance tipped with carbide, standard tips being used and located in staggered arrangement on the broach. The salvaged broach is shown at the left, while the original broach and the part machined with it are shown at the right.

Exceptional results were obtained with this broach. Before salvaging, it was necessary to hone and burnish the original broach after it had machined from 500 to 700 pieces, and after broaching about 1000 pieces it was practically worn out. After salvaging, the number of teeth was reduced from the original 42 to only 10 side

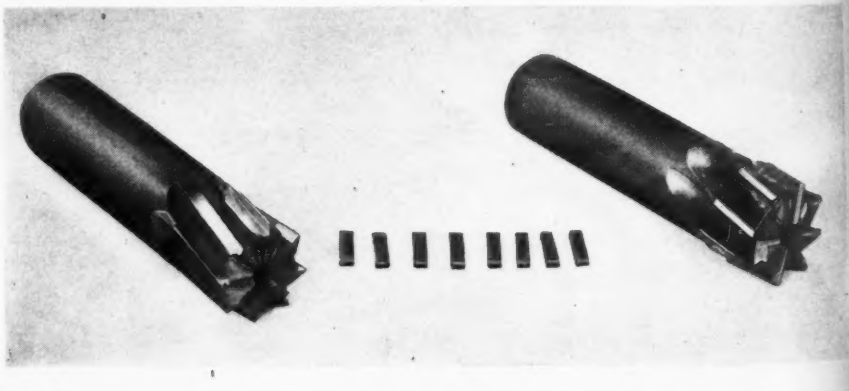
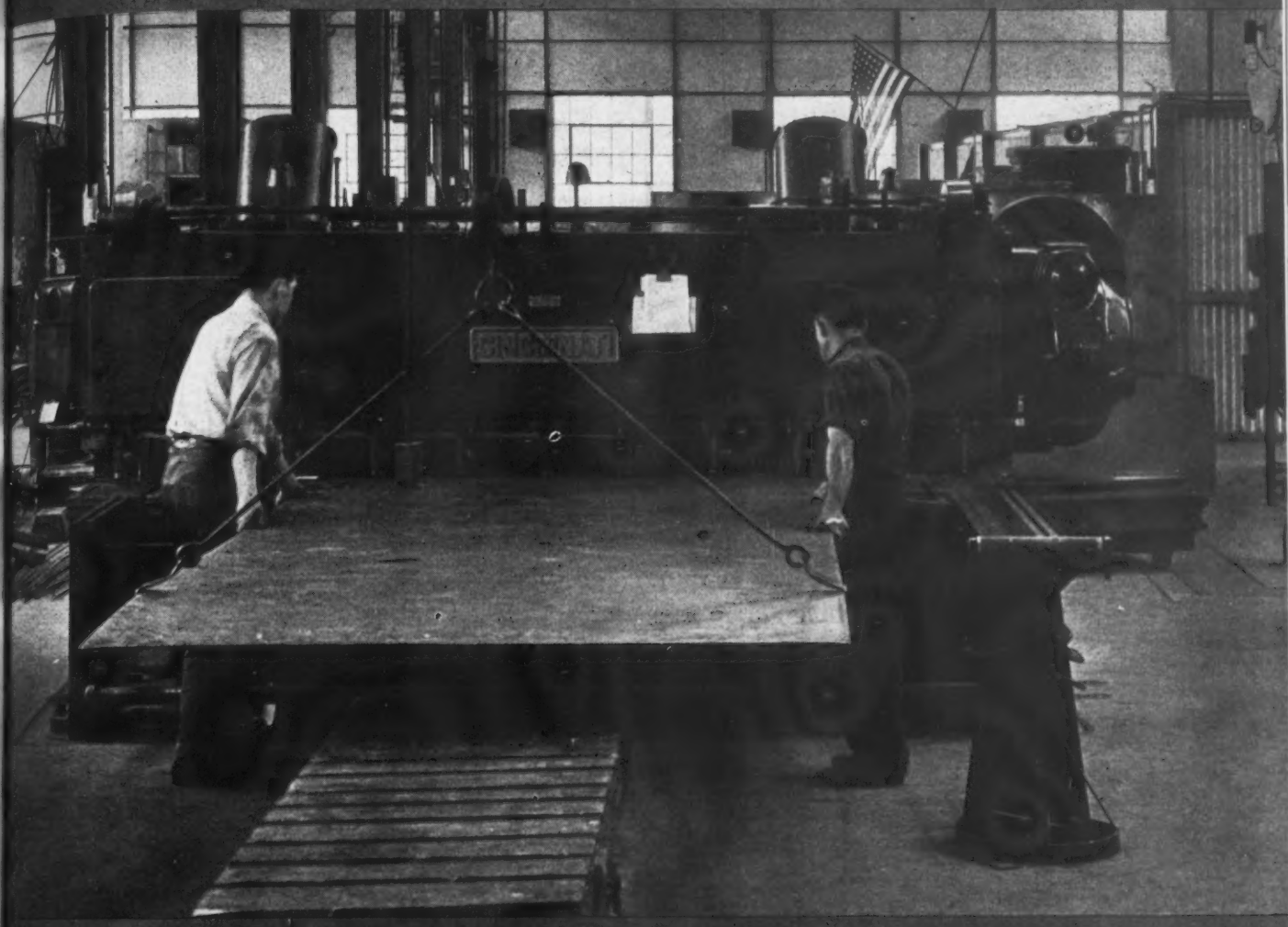
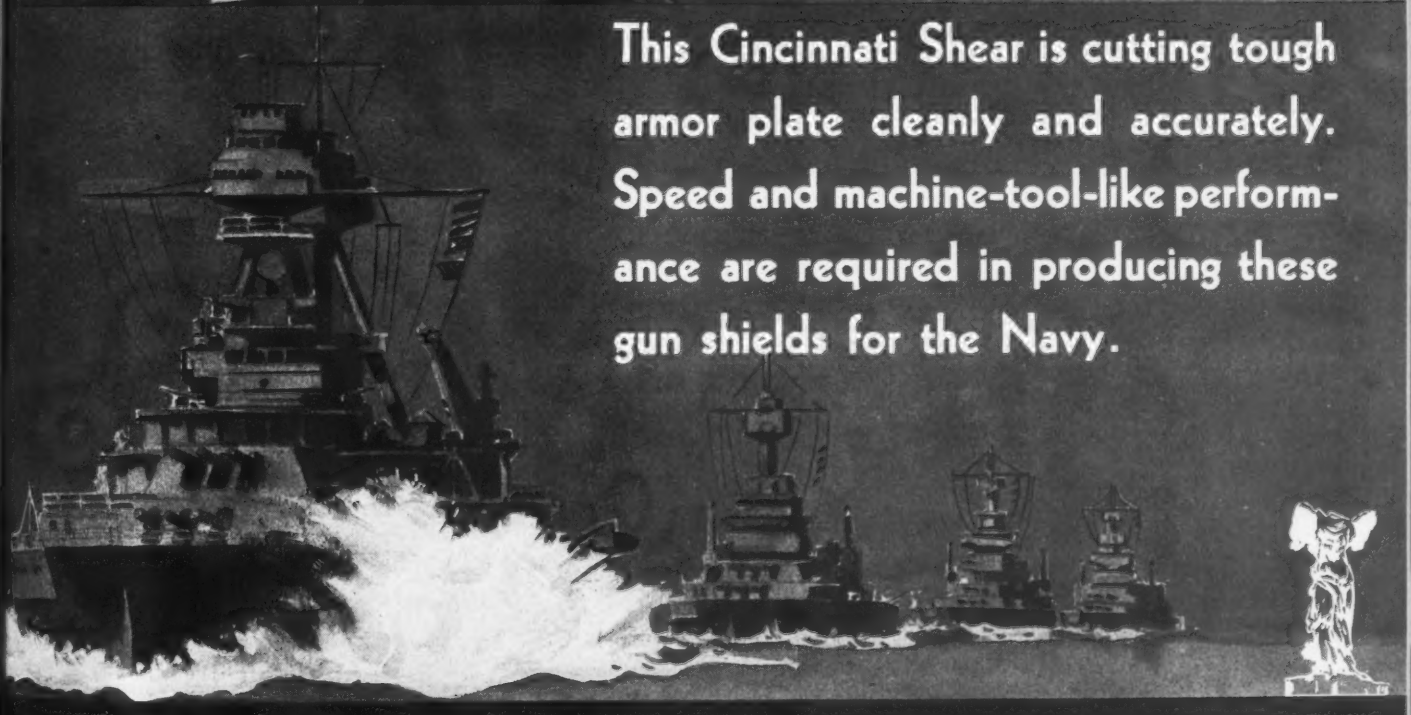


Fig. 3. High-speed Steel Tool before and after Applying Carbide Tips

GUN SHIELDS FOR THE NAVY



This Cincinnati Shear is cutting tough armor plate cleanly and accurately. Speed and machine-tool-like performance are required in producing these gun shields for the Navy.



THE CINCINNATI SHAPER CO.

SHAPERS • SHEARS • BRAKES

CINCINNATI, OHIO

teeth and 13 top teeth, yet the salvaged broach produced around 15,000 pieces. When worn under size, the salvaged broach can be brought back to size by moving out the tips or by brazing on new ones.

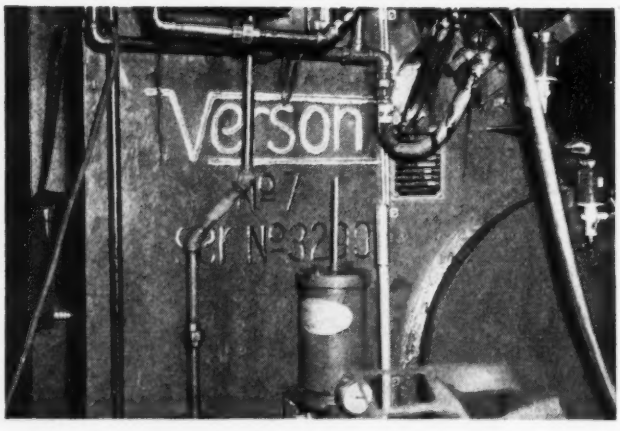
Another high-speed steel tool worn under size was salvaged by tipping, as shown in Fig. 3, again using standard carbide tips. After applying the tips, the outside diameter was ground to the original tool size, thus producing a tool with a longer life expectancy than that of the original tool.

* * *

Lettering Identifications on Shop Equipment by Welding

Electric arc welding is now being utilized to weld names, numbers, and similar identifying data on the frames of presses and other shop equipment. By means of the arc-welding process, machine numbers and serial numbers, and even the trade name of the machine, are being welded directly on the metal base or other surface of the machine, thus becoming a permanent part of the machine. This makes for easy identification, and also prevents the inconvenience and delay resulting from nameplates being obliterated, or even lost when they become loosened by vibration.

The illustration shows how the idea was used to identify a large press. A light outline of the lettering was first chalked on the machine. By following these guide lines with a 3/16-inch shielded-arc electrode, an exceptionally smooth bead of weld metal was applied, forming the letters and figures. In this instance, the letters of the name are 4 inches high, while the machine and serial numbers are 3 inches high. The same idea has been used to designate water-line depths on the prow of vessels, eliminating the work of repainting these markings at intervals.



Press with Trade Name, Machine Number, and Serial Number Welded on the Frame

Renegotiation as Applied to Machine Tool Building

The National Machine Tool Builders' Association has published a booklet on "Renegotiation," in connection with which the committee of the Association that has carried through this work makes the following statement:

"It is an inherent right and duty of every American citizen to direct public attention to any legislation or governmental procedure which he knows from personal experience to be detrimental to the country's welfare, as well as to his private interests.

"The right of American citizens to protest exists during both peace and war, but in time of war our *duty* to call attention to situations inimical to the public interest becomes paramount and compelling.

"In the firm belief that the procedure followed in renegotiating war contracts is contrary to the national interest during either war or peace and is unnecessarily endangering the future existence of certain classes of business, we are asking the Congress and the interested departments of the Executive Branch of the Government to give consideration to our position.

"To this end we have prepared a pamphlet entitled 'Renegotiation,' which discusses this subject as it relates to the machine tool industry. We speak only for this industry, although conscious that there are many others similarly interested."

The booklet covers this subject in considerable detail, referring to specific cases and giving examples worked out in detail.

* * *

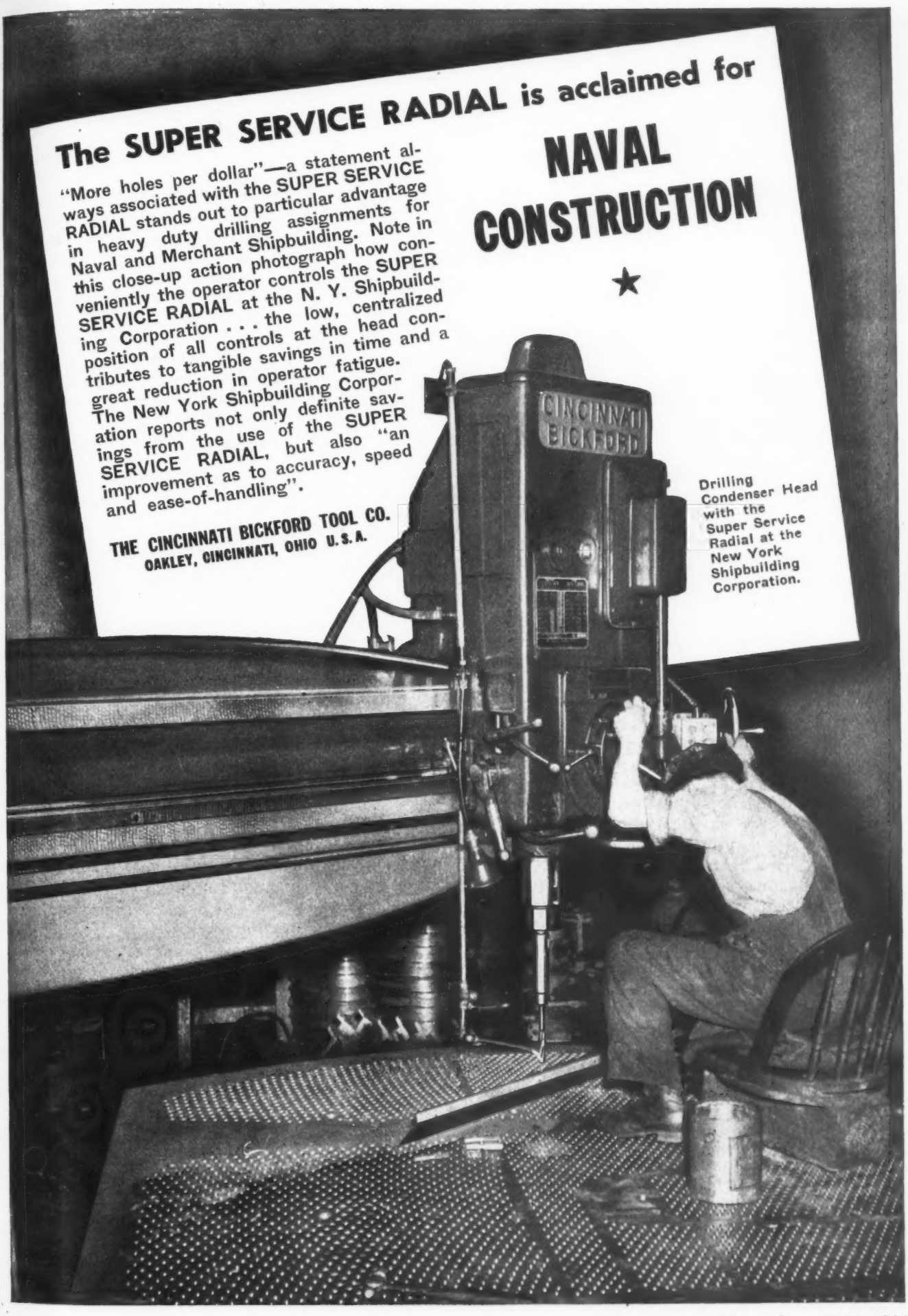
Safety Regulations for Women in Industry

A twelve-page booklet entitled "Safety Regulations for Women in Industry" has been prepared by the General Electric Co. for distribution among its women employes. The booklet is especially directed to women working at machines on what were formerly considered men's jobs. The publication is not intended as a complete safety guide, but as a supplement to the company's book "Safety Instructions and Information."

Single copies of the booklet "Safety Regulations for Women in Industry" can be obtained by requesting the General Electric Co., Schenectady, N. Y., for Publication GEQ-217.

* * *

You cannot help men permanently by doing for them what they could and should do for themselves.


The SUPER SERVICE RADIAL is acclaimed for
NAVAL CONSTRUCTION
★
"More holes per dollar"—a statement always associated with the SUPER SERVICE RADIAL stands out to particular advantage in heavy duty drilling assignments for Naval and Merchant Shipbuilding. Note in this close-up action photograph how conveniently the operator controls the SUPER SERVICE RADIAL at the N. Y. Shipbuilding Corporation . . . the low, centralized position of all controls at the head contributes to tangible savings in time and a great reduction in operator fatigue. The New York Shipbuilding Corporation reports not only definite savings from the use of the SUPER SERVICE RADIAL, but also "an improvement as to accuracy, speed and ease-of-handling".
THE CINCINNATI BICKFORD TOOL CO.
OAKLEY, CINCINNATI, OHIO U. S. A.
CINCINNATI BICKFORD
Drilling Condenser Head with the Super Service Radial at the New York Shipbuilding Corporation.

Why is War Production Lagging?

RECENTLY numerous statements have been published in the technical press, based upon statistics of the War Production Board, indicating that war production is not increasing as much as it ought to, and in some instances is not even holding its own. A production executive who has had the opportunity of noting the conditions in a number of plants making various kinds of war materiel points out a few of the causes for the lagging of production in the following:

1. In the months following Pearl Harbor, the Government agencies did everything possible to establish production facilities, and pushed management and workers alike to the limit, so that these facilities would be used to their utmost capacity. Today, however, this pressure is put on only a few specific lines, of which aircraft is one, while there have been curtailments in the production schedules of many other munitions. Obviously, this will cause a lagging in effort, as well as in output per man. I have seen plants where shell lines are only producing a fraction of their capacity because the Government has curtailed the schedules.

2. It is impossible for the management to maintain the same spirit among the workers when it is obvious that there is no need for high-pressure production in a given plant. When the workers see only partial use of the plant equipment and a limitation on production, they are not likely to maintain the high-pressure tempo of the earlier days.

3. It is not possible for management to maintain output when, as the apparent need for production decreases, inspection becomes more rigid, while when production needs increase, inspectors relax their rigid demands.

4. It is not possible for management to run a plant efficiently when its quotas are varied from month to month, causing a very difficult man utilization problem. Where the production demand is for the maximum possible output of a plant, I have seen very few cases where it is not possible to spur both management and workers to do their utmost.

5. We have completed our job of converting equipment, but we are only now in the process of converting man-power. It is but comparatively recently that our man-power has been diverted to the army and navy services to a serious extent, so that it has become necessary to train women coming out of homes or from other occupations of a non-mechanical character. These women have to be trained before they can work efficiently, and this process will probably continue for another year or more. This change in the character of working forces has had a definite effect on production efficiency.

It is, of course, to be expected that the demand for different types of war materials will fluctuate considerably with the shifting of the phases of the war from one scene to another. We all realize the gigantic nature of the scheduling problem created by these shifts; but there are many doubts in the minds of manufacturers as to whether the scheduling is being done as intelligently as it might be. Be that as it may, it nevertheless remains a fact that machines standing idle in a shop, indefinite monthly allotments, and fluctuating schedules are not conducive to maximum efficiency of the personnel.

Effect of Union Rules and Activities

In the plants that I have had the opportunity to visit, I do not know whether production has actually been slowed up by union *rules*, as in the plants with which the writer is concerned there are not many of the old type trade unions, among whom these rules are most often found. However, I have noted union *activities* which interfere with production. It is difficult to put one's finger on some of these, although they are quite obviously there. A few minor examples will illustrate this point.

1. In a plant making aircraft parts, twenty machine operators went on a 1/2-hour "strike" one day because they felt that they should have two cents an hour more pay.

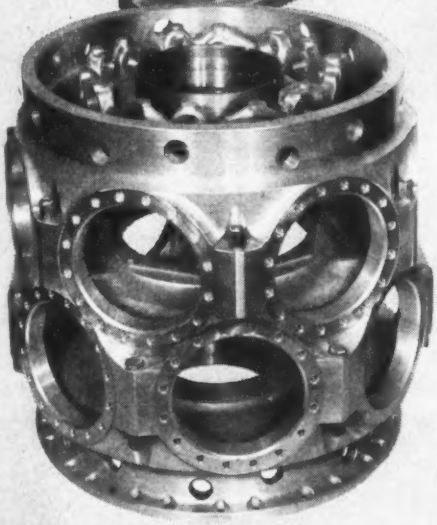
2. In a munitions plant, the inspectors quit twice because they had *heard* it rumored that the production operators would work on a production incentive in which the inspectors would not participate. In another plant, molders worked at less than 50 per cent of their capacity because they did not think that the production bonus was worth going after.

3. In another munitions plant, several strikes occurred because the War Labor Board did not act quickly enough in a wage case. The workers admitted that they had no quarrel with their employer, but that the strike was against the Government. This is not an unusual case, according to various accounts in the newspapers.

4. A union in one plant of a company has tried to organize unions in other plants of the same organization, so that they might deal directly with the headquarter's management "to combat company policies." This union has tried very hard to stress its desire to cooperate with the management, its idea of cooperation being for management to yield to all the demands of the union.

There's no substitute for EXPERIENCE!

Ex-Cell-O's wide experience in designing and building special machines to increase output and lower costs assures you practical advantages in your immediate or near future production



Increased production attained in precision machining of this aircraft crankcase on the above Ex-Cell-O special-purpose machine.

You have a substantial background of experience to draw from when you bring to Ex-Cell-O your problem in the *precision* machining of metal parts on a high production basis . . . whether it concerns an immediate war production job or a future product you are now planning. The more economical production of accurate metal parts necessitates single-purpose machines of improved efficiency, capable of giving greater output and reducing unit cost. For years Ex-Cell-O has been an acknowledged leader in the field of special-purpose machines . . . *precision* machines with exclusive features that represent the utmost in accuracy, production, operating ease, rigidity, and durability. This is why you should utilize Ex-Cell-O's experienced engineering and manufacturing facilities. Ex-Cell-O has representatives in all of the nation's principal manufacturing centers. Consult the one nearest you, or write to Ex-Cell-O Corporation Head Office in Detroit.

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Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

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5. In one plant recently visited, the National Labor Relations Board split the plant into two units and certified both the A. F. of L. and the C.I.O. as bargaining agencies over the separate units. As a result, bickering between the two unions has placed the management in a difficult position and seriously interfered with production. In addition, efficient use of man-power is impossible because of the rules restricting the kind of work each union is permitted to do.

Lost Time through Needless Bargaining and Bickering

Few people recognize the tremendous waste in production and in management man-power resulting from the endless bargaining and bickering in present-day union-management dealings. No reasonable man denies the right of anyone to seek the best working conditions from the company that employs him; nor will any reasonable man deny the right of a worker to seek this through a duly appointed spokesman. But any straight-thinking man is likely to question the wisdom and justice of our procedure when the laws restrict the rights of one party—the employer—while leaving full scope to the activities of the other party—the labor leader.

Recently passed labor legislation permits men who have no knowledge of management to force wasteful practices of operation upon the men conducting a business, to force a man to accept or maintain membership in a union against his will, and to create a condition of class consciousness, all in the name of "social reform" and "social justice." Under these conditions, free enterprise, as it has been known in America in the past, and under which America has become the leading industrial nation in the world with the highest standard of living, has largely vanished. The story of France immediately before the war is a clear-cut example of disintegration of a democracy through ill-advised social reforms.

Labor conditions will continue to improve through peaceful evolution rather than by revolutionary law-making. Legislation may guide this evolution, but the law-makers should take care that fairness to all is preserved and that labor legislation does not become one-sided. In the long run, such legislation will prove a detriment to the best interests of labor.

* * *

"Salvage departments in our industrial plants should be continued after the war," says Kyle Fowler, salvage supervisor of the Westinghouse East Springfield, Mass., plant, in *Metals and Alloys*, "so as to conserve our natural resources. A properly organized salvage department will repay the manufacturer many times over in actual cash savings."

Unusual Case of Contour Sawing

By H. J. CHAMBERLAND

Very large amounts of important materials can be saved by using contour band saws whenever these are applicable. As an example of what can be accomplished, the following case is cited.

The material handled was a piece of SAE 4140 heat-treated steel, 7 inches in diameter by 9 1/2 inches long. This piece was to be made into a fixture for thread-milling piston tubes. Similar parts had previously been machined by conventional methods, but owing to the large amount of scrap resulting from the machining process, it was decided to attempt to do the work by contour sawing in a DoAll machine, using a 3/16-inch, 10-pitch, A temper saw.

The work consisted of sawing out a tapered conical part from the center of the piece, to provide a conical bore. This bore measured 5 inches at the large end and 2 inches at the small end. A 1/4-inch starting hole was drilled through the part at a 9-degree angle. The sawing operation allowed 3/16 inch stock in the bore to machine it to size.

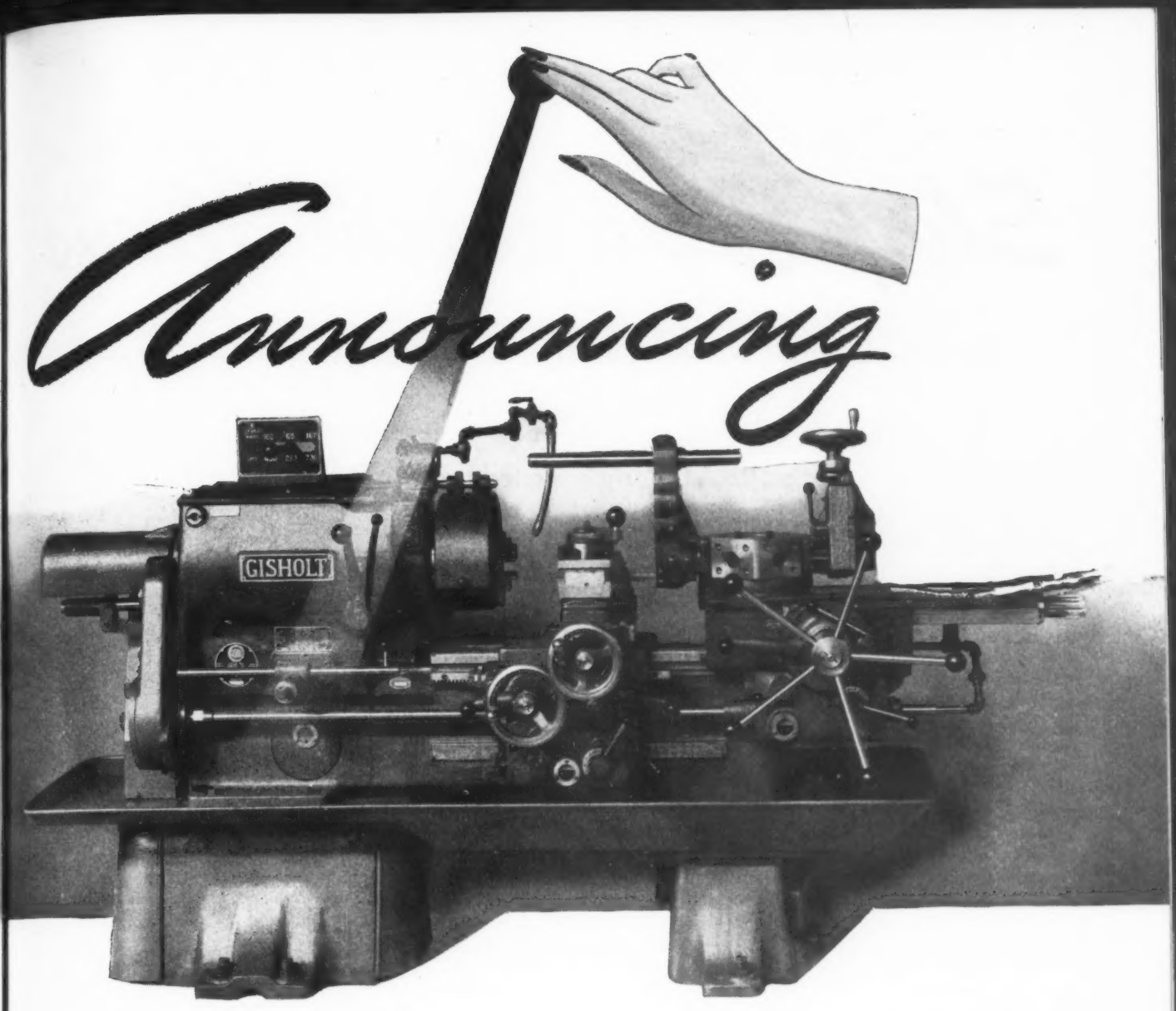
After setting the contour machine table to an angle of 9 degrees, the saw was passed through the hole and the ends of the saw butt-welded. The operator then started to feed and control the sawing operation manually, without using a coolant. After taking about 1 inch of the circular cut at the large end, the power feed was employed, and kerosene at the rate of one drop per second was applied. A marked increase in the cutting rate resulted, and very little heat was generated.

The work was handled by an operator with less than two weeks' training in handling sawing work of this kind. It is obvious that if a 5-inch diameter straight hole had been required instead of a tapered hole, the larger radius would have permitted the use of a wider band saw, with an appreciable increase in the cutting rate.

In using this method, it must be noted that not all metal-cutting band saws could stand so severe a strain, because the nature of the cut requires a saw having the correct depth of tooth hardness to provide teeth with ample flexibility. A saw not hardened properly for this purpose is not suitable for sawing curved work, because the teeth soon rip or lose their set.

* * *

If we win this war and continue to suppress the rights of the individual to develop his latent ability, we will have lost everything that any free individual can fight for, regardless of the military outcome.—*James F. Lincoln, president, Lincoln Electric Co.*



SMOOTHER, SWIFTER, EFFORTLESS OPERATION

with hydraulic clutching and braking

Now, as an aid to war production, Gisholt announces hydraulic control for starting, stopping and reversing the spindle. It takes only a flick of the control lever—right or left—to engage the forward or reverse clutches. In neutral, or stop position, automatic hydraulic braking of the spindle brings work quickly and smoothly to rest.

This finger-tip control saves time, of course. It speeds up production, especially where rapid work calls for frequent starting and stopping of the machine. It saves effort; for muscle power is supplanted by hydraulic power. It enables women to "man" the turret lathes without physical exertion. And clutches may be adjusted to pull the heaviest cuts that the tools and work will stand.

For over two years this hydraulic control has been proved and perfected under actual shop conditions. It is now supplied as standard equipment on all Gisholt Ram Type Turret Lathes.

GISHOLT MACHINE COMPANY
1209 East Washington Avenue • Madison, Wisconsin

LOOK AHEAD • KEEP AHEAD • WITH GISHOLT *IMPROVEMENTS IN METAL TURNING*

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Huge "Red Ring" Gear-Shaving Machine

A new "Red Ring" gear-shaving machine weighing 75,000 pounds has been brought out by the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. Gears from 24 to 96 inches pitch diameter and up to 97 inches outside diameter can be shaved on this machine, which is claimed to be the largest of its kind ever built. It has a base 20 feet by 12 feet 11 inches, and stands nearly 11 feet above the floor line. Its maximum shaving range from the headstock spindle is 110 1/2 inches. This machine is particularly well adapted for the production of highly accurate gears for large steam-turbine reduction units and large Diesel-engine timing gears.

Like other "Red Ring" gear-shaving machines, it is designed for rotary crossed-axes shaving. The cutter-head is equipped with a vernier scale and sine bar, so that settings to any desired angle within its range can be readily made and any setting can be accurately duplicated. The cutting tool, which is free to rotate, is driven by the work gear.

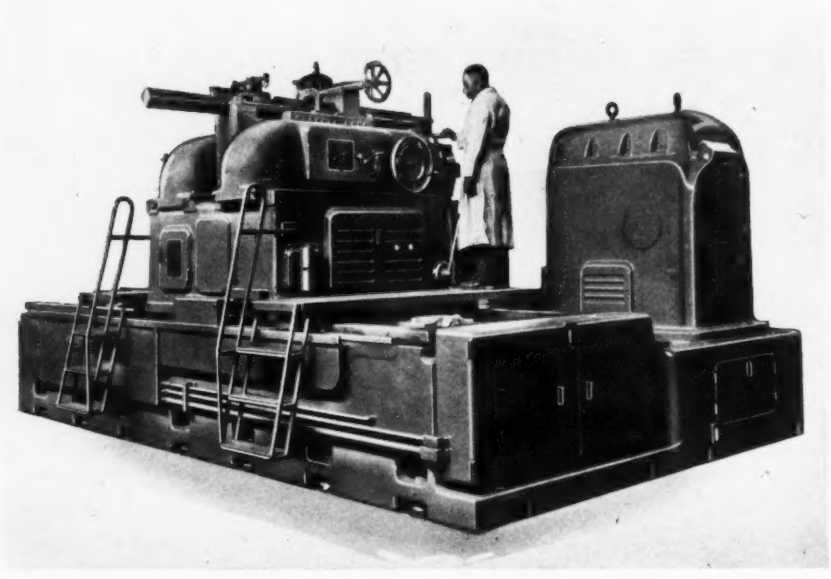
Provision is made for accurately checking the work gear without removing it from the machine. The checking head, which is an integral part of the machine, is used to determine the size of the work gear, the amount of shaving stock on it, its linear pitch, wabble, eccentricity, and pitch diameter. The operator can check the work gear alignment from either side of the machine.

Although the illustration does not show a work gear in the shaving position, the machine is arranged for mounting this gear on journal bearings supported by adjustable pedestals. The headstock is a self-contained unit with its own motor drive, special journaled sleeve type bearings, and change-gears for regulating the speed of the work gear, the latter being driven through a flexible coupling.

The cutter-head and checking head are mounted on a saddle, forming a self-contained unit with its own motor drive, pressure lubrication, and controls which govern the length of stroke and which include a safety stop. The cutter-head slide is reciprocated across the face of the work gear during the cutting cycle, and is equipped with automatic feed and a pre-selector for varying the amount of feed. The cutting cycle can be controlled either manually or automatically.

Pressure lubrication is used throughout, and all lubricant reservoirs are provided with sight gages. The doors of the electrical panel cabinet are interlocked with the main circuit, so that they can be opened only when the main current is off.

In the illustration, the operator is shown in position for starting the cycle and within easy reach of push-buttons which control the complete operation of the machine. At this control station are a master stop, saddle feed selector, coolant and headstock controls, and forward, reverse, and stop controls. A bank of lights shows the operator whether or not the saddle feed is engaged and the direction of movement. On the side of the machine opposite the operator is a similar control station. At the base of the work headstock is a third control station with a master stop push-button and another button for jogging the work-spindle in either the forward or reverse direction. 51



"Red Ring" Gear-shaving Machine with Capacity for Finishing Teeth of Gears up to 97 Inches in Diameter

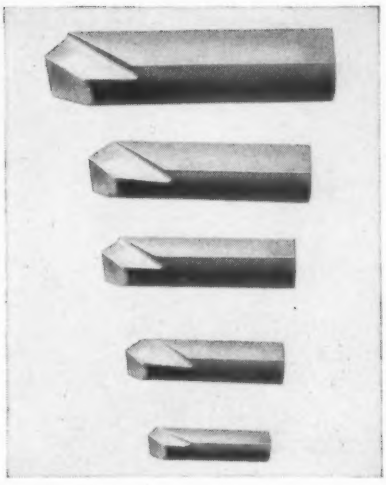
To obtain additional information on equipment described on this page, see lower part of page 196.

Kennametal Boring Tools

A line of solid round Kennametal tools in the ground condition, ready for immediate use in precision boring machines, is announced by Kennametal, Inc., 147 Lloyd Ave., Latrobe, Pa. Heretofore a series of Kennametal solid round blanks only were available, requiring that the customer grind the cutting point of the tool to suit his purpose.

The 27SR tools, having a side cutting edge angle of 30 degrees and an end cutting edge of 38 degrees, are intended for use primarily in a 30-degree boring-bar; and the 29SR tools, having corresponding angles of 45 and 53 degrees, are designed for use in a 45-degree boring-bar.

Five sizes are available in each style—namely 3/32, 1/8, 5/32, 3/16, and 1/4 inch. Tolerances are held to plus 0.000, minus 0.001 inch on the diameter and to plus 0.000, minus 0.005 inch on all other dimensions. These tools are kept in stock ready for delivery in grades K3H and K4H. 52



Kennametal Round Boring Tools

Pratt & Whitney "Air-O-Limit" Gage for Inspecting Bores

The Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., has developed an "Air-O-Limit" bearing gage for checking or inspecting holes and bores for errors in straightness, roundness, and size. The outstanding feature of this comparator type gage is that the product being gaged is not touched by any mechanical gaging point or plug. Thus the surface of the hole being checked will not be scratched or even burnished, no matter how soft the material.

This gage was originally developed to check lead-indium plated aircraft engine bearings which have surfaces so delicate that high-speed gaging without marring or scratching requires an instrument that does not actually touch the sides of the bore. The particular gage illustrated in Fig. 1 has gaging spindles for inspecting bores from 2 to 5 inches in diameter. A smaller model is available for bores as small as 1/2 inch.

The principal components of the gage are the gaging fixture, gaging unit, and the air-supply equipment. The gaging fixture has a ball-supported work-carriage that positions the work over the air type gaging plug. The carriage has two V-type locating blocks with tungsten-carbide inserts. The V-block nearest the operator locates the master ring for setting the gage for a given diameter, while the other V-block locates the work to be gaged. All master gages have the same outside diameter, which is concentric with the internal diameter to close limits.

The air-control cabinet contains a filter unit for removing moisture and foreign matter from air taken from the shop line. The air passes from the filter to a pressure-reducing valve, where it is stepped down to 50 pounds per square inch. Next, the air passes to a second adjustable pressure valve for a further reduction to 30 to 40 pounds per square inch for operating the gaging unit. This valve contains a mechanical adjustment for accurate zero setting of the gage indicator, the low pressure being read on a meter.

The air from the air-control cabinet is fed into the rear of the gaging unit, clamped to the column

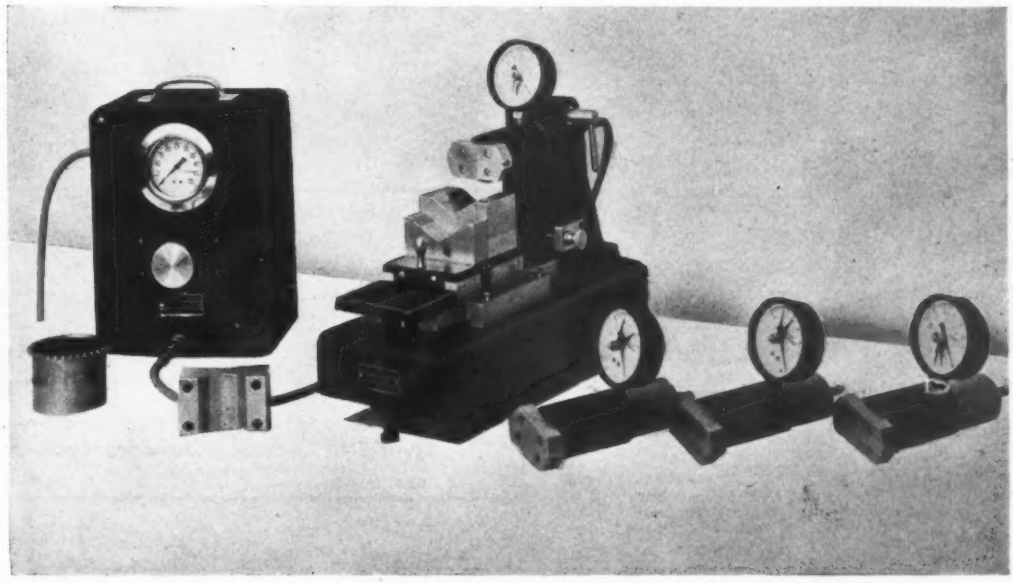
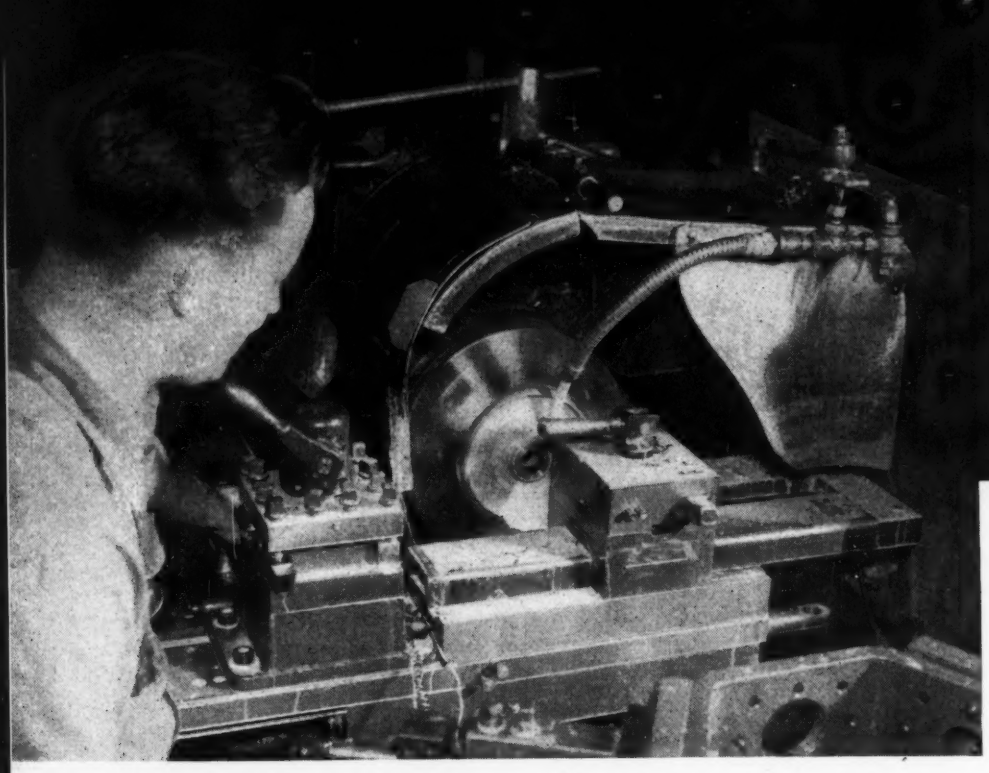


Fig. 1. Pratt & Whitney "Air-O-Limit" Gage with Three Interchangeable Spindles and Extra V-block for Various Internal Diameter Inspections

To obtain additional information on equipment described on this page, see lower part of page 196.



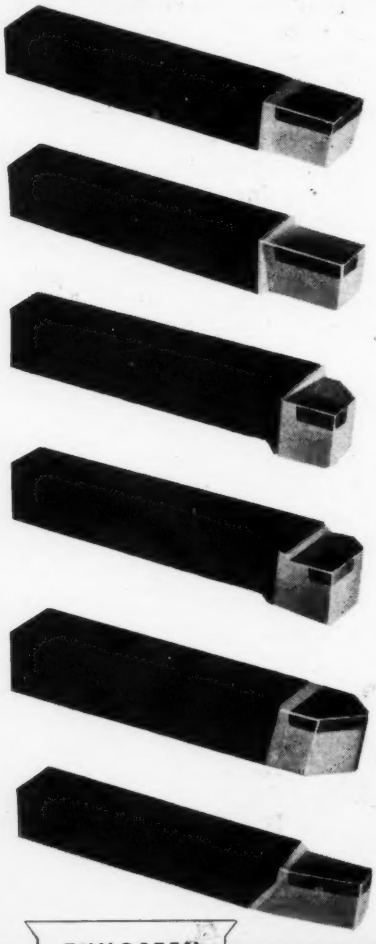
★

When carbide tools are correctly used, vital production time is saved! In the machining of this steel gear for superchargers, Carboloy tools, cutting at 220 F.P.M., save 81% of time formerly required. Carbide tools face, turn, bore, form, undercut and chamfer . . . and eliminate an extra pass of tools across work.

SELECT STANDARD TOOLS FOR MAXIMUM UTILITY AND AVAILABILITY

General Purpose Standards for Turning, Boring, Facing

Shanks Painted Red for Quick Identification



Style T-1. Square nose general purpose turning, boring, facing tool—13 stock sizes.

Style T-7 (left hand) shown—Style T-4 (right hand) available—16 stock sizes.

Style T-9 (left hand) shown—Style T-5 (right hand) available—8 stock sizes.

Style T-11 (left hand) shown—Style T-10 (right hand) available—8 stock sizes.

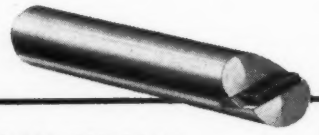
Style T-12. Round nose general purpose turning, boring, facing tool—5 stock sizes

Style T-14 (left hand) shown—Style T-13 (right hand) available—14 stock sizes.

Other Standards

BORING TOOLS

Standard round shank boring tools for precision boring. Stocked in sizes from ⅜" dia. to ½" dia.

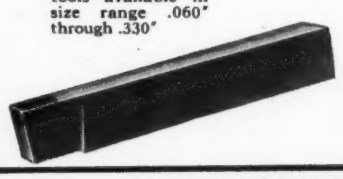


SHEAR TYPE TOOLS

For interrupted cutting on large forgings, castings, etc. Stocked in four sizes.

GROOVING TOOLS

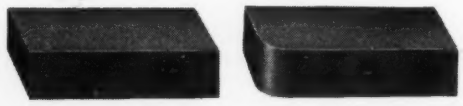
Standard grooving tools available in size range .060" through .330"



ROLLER TURNERS (BOX TOOLS)

Standard for Warner & Swasey and Gisholt turret lathes.

GENERAL PURPOSE STEEL CUTTING BLANKS



145 different blanks available for rapid delivery. For fast emergency tooling make your own tools.

***See Catalog GT-142 for Prices and Specifications of Over 300 Carboloy Standard Tools and Blanks**

TUNGSTEN CARBIDES For Cutting CAST IRON and Non-Ferrous Metals

CARBOLOY

TITANIUM TANTALUM CARBIDES For Cutting STEEL

FOR HEAVY HOGGING • • • PRECISION FINISHING • • • INTERMITTENT CU

CUTTING STEEL

For top performance when you cut steel with carbide tools ★ cut at high speeds, in general, not less than 200 feet per minute ★ Use feeds not less than .010″ per revolution (for medium and heavy cuts), and preferably .015″ to .025″ ★ Fit correct chip breaker to each job (the ground-in, step-type is usually best) ★ If you use a coolant, provide heavy, continuous stream ★ Keep tools sharp (excessively dull tools cause breakage) ★ Use rigid set-ups; with minimum overhang, and part chucked firmly. These factors are particularly important for best results when cutting steel.

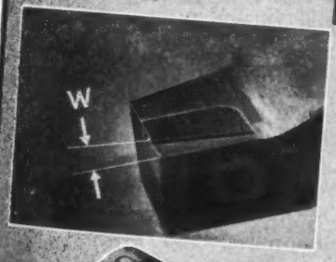
Important, too, is the type of carbide you select. Today, more than 60% of all Carboloy Cemented Carbide produced for machining purposes is used for cutting steel. In leading war plants throughout the nation—you find Carboloy tools giving top performance on all types of steel cutting, ranging from extra heavy jobs to light, high-speed precision finishing.

A new 16-page pocket manual on steel cutting, to help your plant get maximum results, is available free on request. In quantities, for general distribution, if desired.

Guide to CARBIDE GRADES & CUTTING SPEEDS

Chart at right shows suggested carbide grades and cutting speeds for average conditions. When conditions are excellent (good rigidity, etc.), Grade 78 may be substituted for 78B in column 2, and Grade 831 for 78 in column 4. Adjustments in cutting speeds may be made upward (for steels under 200 Br.) and downward (for steels over 300 Br.) within a 25%-30% range of speeds shown. For steels 400 Br. and over, use speeds 50% less than speeds shown.

	STEEL TO BE CUT	FOR AVERAGE WORK									
		Col. 1		Col. 2		Col. 3		Col. 4		Col. 5	
		7/16″ to 3/4″ Cut .020″ to .030″ Feed		3/16″ to 3/8″ Cut .015″ to .025″ Feed		5/64″ to 5/32″ Cut .010″ to .020″ Feed		1/64″ to 1/16″ Cut .008″ to .012″ Feed		.005″ to 1/64″ Cut .002″ to .008″ Feed	
		Speed F.P.M.	Carbide Grade	Speed F.P.M.	Carbide Grade	Speed F.P.M.	Carbide Grade	Speed F.P.M.	Carbide Grade	Speed F.P.M.	Carbide Grade
Carbon	S.A.E. 1010-1025	250	78B	300	78B	375	78	500	78	675	831
	S.A.E. 1030-1095	200	78B	250	78B	300	78	400	78	550	831
Free Cutting	S.A.E. 1112-1120	250	78B	300	78B	375	78	500	78	675	831
	S.A.E. X1314-X1340	225	78B	275	78B	350	78	450	78	600	831
Nickel Mo	S.A.E. T1330-T1350	175	78B	200	78B	250	78	350	78	475	831
	S.A.E. 2015-2320	225	78B	275	78B	350	78	450	78	600	831
Nickel-Chrome	S.A.E. 2330-2515	200	78B	250	78B	300	78	400	78	550	831
	S.A.E. 3115-3140	200	78B	250	78B	300	78	400	78	550	831
Cr. Mo	S.A.E. 3145-3450	175	78B	200	78B	250	78	350	78	475	831
	S.A.E. 4130-4820	175	78B	200	78B	250	78	350	78	475	831
Cr. V.	S.A.E. 5120-52100	175	78B	200	78B	250	78	350	78	475	831
	S.A.E. 6115-6195	175	78B	200	78B	250	78	350	78	475	831
	S.A.E. Cast Steel	200	78B	250	78B	300	78	400	78	550	831



USE OF CHIP BREAKER

Fit each chip breaker to the job. Ground-in, step type shown at left is usually best. Chart below shows recommended width "W". (Breaker depth of .020″ generally satisfactory).

FEED → In. Per Rev.		.008-.012	.013-.017	.018-.022	.023-.027	.028-.032
Depth Cut Inches	1/64-3/64	1/16	5/64	3/32	7/64	1/8
	1/16-1/4	3/32	1/8	5/32	11/64	3/16
	5/16-1/2	1/8	5/32	3/16	13/64	7/32
	9/16-3/4	5/32	3/16	7/32	15/64	1/4

6 Carboloy Training Films Available for Use in Your Plant.

SEND FOR THIS FREE POCKET MANUAL →

Just off the press, a 16-page pocket manual on cutting steel with carbides. Shows how to determine correct rakes and angles, tool nose radius, cutting speeds, carbide grades, chip breakers. Contains guide to machine requirements, best use of coolants, and two pages of illustrated "Do's and Don'ts" for operators using carbide tools. Free upon request. Quantities available for plant distribution.

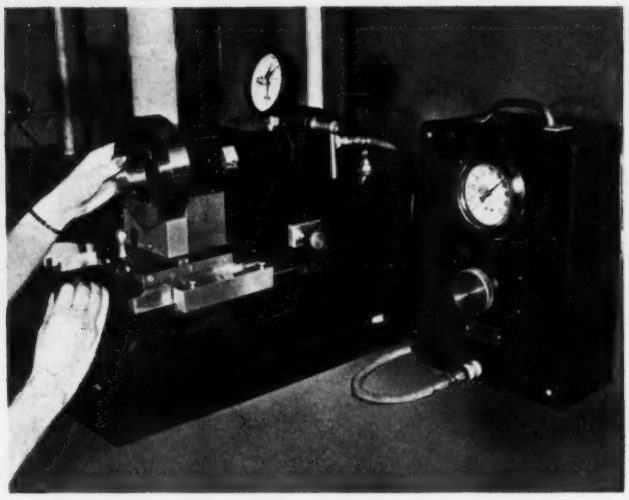
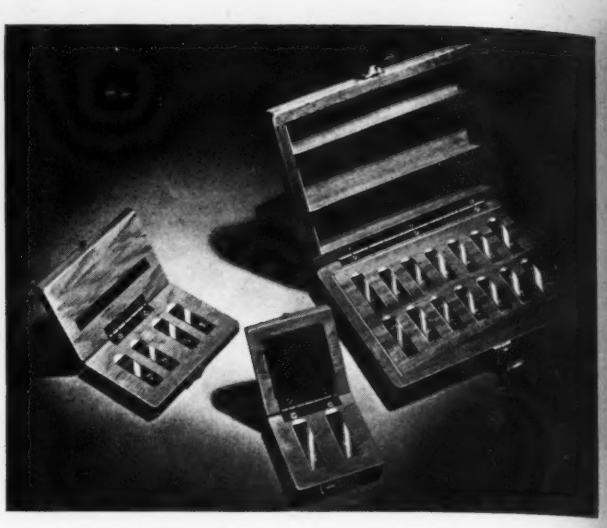


Fig. 2. Method of Using Master Ring to Set "Air-O-Limit" Gage



"Carblox" Gage-blocks Developed by the Lincoln Park Tool & Gage Co.

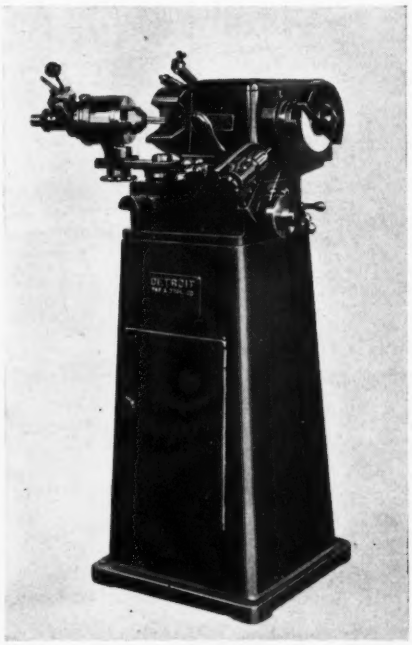
of the gaging fixture. Here the air passes through a restriction tube and thence to two orifices on opposite sides of the gage plug. The clearance between each orifice and the adjacent bearing wall is usually 0.003 inch. The air gap so created restricts free flow of air from the orifices, and the back pressure is calibrated in terms of 0.0001 inch on the indicator dial. The use of two orifices permits a spot reading at any plane; consequently, out-of-roundness is detected by rotating the bearing, and taper by traversing the work-carriage. 53

Improved Tap Reconditioner

An improved design of tap reconditioner or grinder has just been announced by the Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich. A feature of this improved design is a new spindle head that accommodates a wide range of motors for the various service voltages, phases, and frequencies required in the industry. High rigidity of the spindle head and continuous adjustability to compensate for grinding tool wear are obtained by mounting the spindle assembly on large dovetail ways in the pedestal base.

The tap-chamfering unit located at the left of the machine is of the precision collet type, and has been improved to facilitate changing taps and collets and to assure maximum locating accuracy. It will accommodate collets from the smallest machine screw size up to 1 1/4 inches standard tap shank size, including long-shank taper taps. Spiral pointing and spiral-point polishing operations can be performed by integral units of the machine, the spiral-pointing mechanism being driven from the new spindle head.

The 1/2-H.P. spindle motor is controlled by a manual switch mounted in the base. Standard motors are 220- or 440-volt three-phase and 110-volt single-phase for either 25- or 60-cycle service. 54



Improved Tap Reconditioner Made by Detroit Tap & Tool Co.

"Carblox" Gage-Blocks

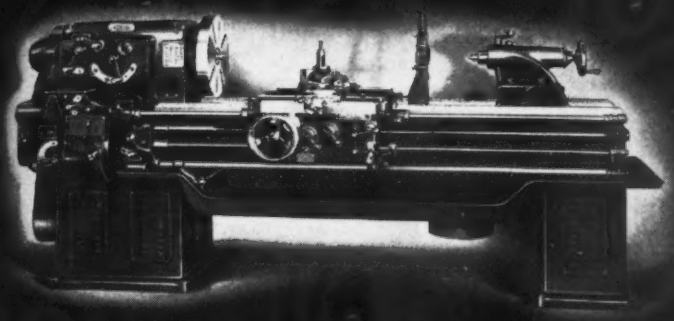
The Lincoln Park Tool & Gage Co., Lincoln Park 25, Mich., has developed a new line of gage-blocks designated "Carblox." These gage-blocks are made of cemented carbide to lessen wear and thus insure a higher degree of accuracy and longer life for the gage-blocks.

In some cases, the Carblox gage-blocks have been found to retain their accurate size within the allowable wear tolerance at least fifty times longer than steel blocks used for the same purpose. The greatest wear on gage-blocks occurs, of course, on the end blocks which come in contact with the work. Only a relatively small amount of wear is caused by the wringing together of the blocks. The Carblox used on both ends of the built-up set of blocks act as protective anvils and prevent wear on the less wear-resistant steel blocks.

The new blocks are practically non-magnetic, and are highly resistant to rust or corrosion. Their cohesive factor facilitates the wringing together of thin blocks. These blocks are finished to "A" accuracy (0.000004 inch) and "B" accuracy (0.000008 inch) as a series of gage-blocks built up or wrung together for gaging a given dimension or as individual blocks when a built-up set of blocks is not required. The full built-up range of the standard 81-piece set of gage-blocks is available when the Carblox are used. For example, in a 0.4051-inch built-up set of blocks, one 0.050-inch Carblox and one 0.0501-inch Carblox would be used

To obtain additional information on equipment described on this page, see lower part of page 196.

Sidney 16 Speed Group



Sidney 16 speed lathes are built in a wide range of capacities from 14″ to 36″.

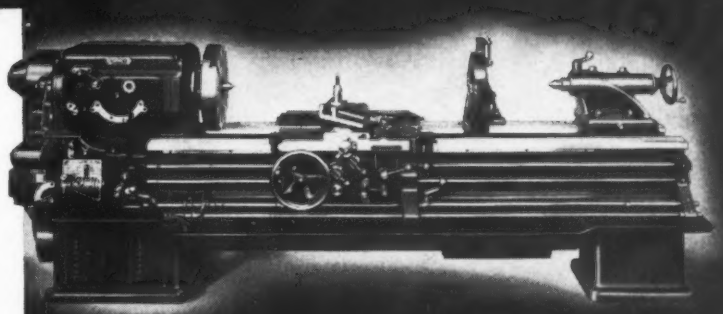
All of these 16 speed models feature continuous tooth Herringbone gearing not only well known but recognized for the greater strength and smoother action resulting from greater tooth contact.

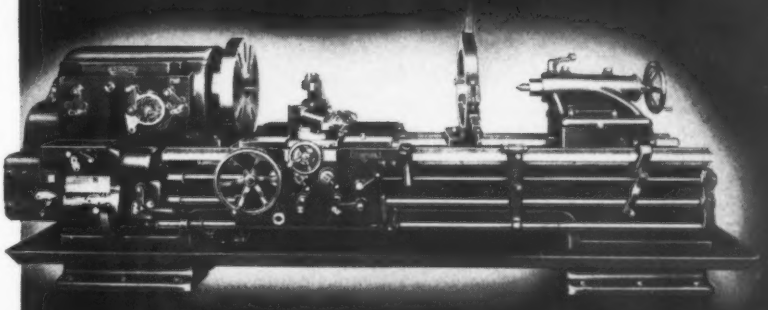
Sidney continuous tooth Herringbone gears are generated and lapped in our own plant to assure the utmost accuracy and smoothest possible finish.

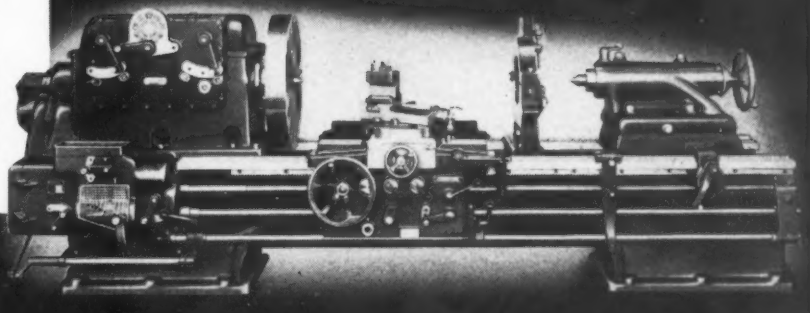
This gearing not only affords greater, smoother power on all sizes but results in highly finished, accurate work free of all tooth marks.

The Headstock is particularly quiet in operation with both spindle and intermediate shaft supported by a center bearing. Internal and external gear tooth clutches operating on multiple spline shafts reduce backlash to a minimum and permit of easy engagement.

For power, speed and continued accuracy Sidney Lathes offer the utmost in dependable lathe performance. Bulletins available.







The SIDNEY MACHINE TOOL Company

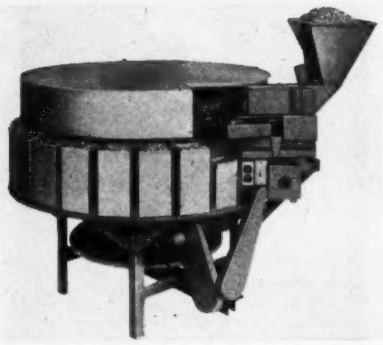
Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

with one ordinary 0.200-inch block and one ordinary 0.105-inch gage-block. The 0.05005-inch Carblox further supplements the regular set of gage-blocks. 55

Automatic Screw, Bolt, and Rivet Sorting Machine

A new machine designed for use in aircraft, automobile, and ship-building plants, which automatically sorts to length dural, brass, and steel machine screws, bolts, and rivets, has been brought out by the Tubin Engineering & Mfg. Co., 764 S. San Pedro St., Los Angeles 14, Calif. The machine delivers from 85,000 to 100,000 sorted parts in eight hours, sorting them in groups with variations in length of 1/8, 1/16, or 1/32 inch. Twenty-four different lengths can be sorted at one time into separate receptacles, with a throw-off receptacle for lengths not provided for.



Tubin Automatic Machine for Sorting Bolts, Rivets, and Screws

A girl can handle as many as five machines. An alarm sounds when the hopper is emptied. The machine has a friction-drive 1/4-H.P. motor operating on 110 volts alternating or direct current. It has a height of 48 inches, occupies 5 square feet of floor space, and weighs 1200 pounds. 56

Continuous Milling Fixtures for Producing Formed Strip or Bar Stock

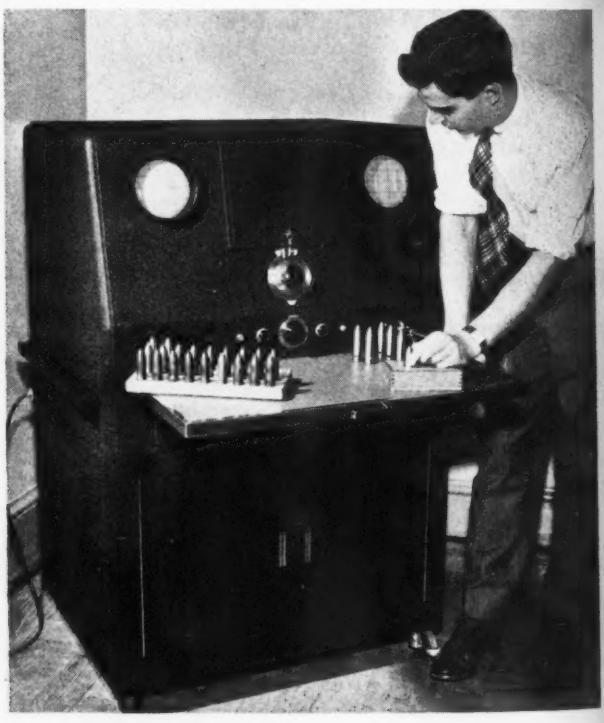
As deliveries of formed stock are often slow and the prices for this type of material high, some concerns have found it advantageous to produce formed stock by continuously milling bar stock to the required form. For this work, the U. S. Tool Company, Inc., Ampere (East Orange), N. J., has developed a self-contained, motor-driven continuous milling fixture, which can be adapted to any of the standard makes of milling machines. These units can be built in any size to meet the customer's requirements, depending upon the material to be milled and the size of the milling machine with which the fixture is to be used.

The fixtures are equipped with motor-driven feed-in and take-out rolls to control the movement of the bar stock through the fixture to the very end of the bar, thus eliminating waste. The feed-in and take-out rolls are grooved to accommodate the particular shape of bar stock being handled. 57

Du Mont Cyclograph for Checking and Sorting Metals and Alloys

An ingenious electronic instrument that checks, evaluates, and automatically sorts metals and alloys according to their individual characteristics has been developed by the Allen B. Du Mont Laboratories, Inc., 2 Main Ave., Passaic, N. J. With this equipment, the average worker can check, evaluate, or sort production pieces, samples, or material stock of varying metallurgical characteristics both rapidly and dependably, thus accomplishing

U. S. Multi-Miller Equipped for Continuous Form-milling of Bar Stock



Cyclograph Developed by Allen B. Du Mont Laboratories, Inc.

To obtain additional information on equipment described on this page, see lower part of page 196.

BROACH LIFE BOOSTED 50%

SUNICUT

"eliminates 1 out of 3 broach changes . . . ups production"

Half again as many parts for war machines broached between every tool change! That's the answer a certain well-known metal-working plant made to the demand for increased war production . . . an answer made possible through the use of Sunicut sulphurized cutting oil as recommended by a Sun Doctor of Industry.

Previously the time lost in changing and resharpening broaches put a drag on production . . . so a Sun Oil Engineer was consulted. After a careful survey of conditions a change to Sunicut 196 cutting oil was advised . . . with the result that broach life increased 50%! One-third of the time formerly lost changing broaches is now employed productively in turning out more pieces per day.

War plants everywhere—out to step up production—are finding the high heat-absorbing and metal-wetting qualities of Sunicut an important aid. On automatics, semi-automatics, gear-cutting machines as well as broaches, let Sunicut help you turn out a better job . . . faster . . . with maximum tool life. Discuss it with a Sun Doctor of Industry today. Write

SUN OIL COMPANY • *Philadelphia*

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS *HELPING INDUSTRY HELP AMERICA*

in a routine manner work that would otherwise require the services of skilled metallurgists with well equipped laboratories.

When used as an electronic analyzer, the Cyclograph, by the use of tests at several frequencies—either one after the other or simultaneously—will grade pieces of metallic material according to case depth, depth of decarburization, amount of cold-working, brittleness (stress gradients), hardness gradients, and structure without injury to the work.

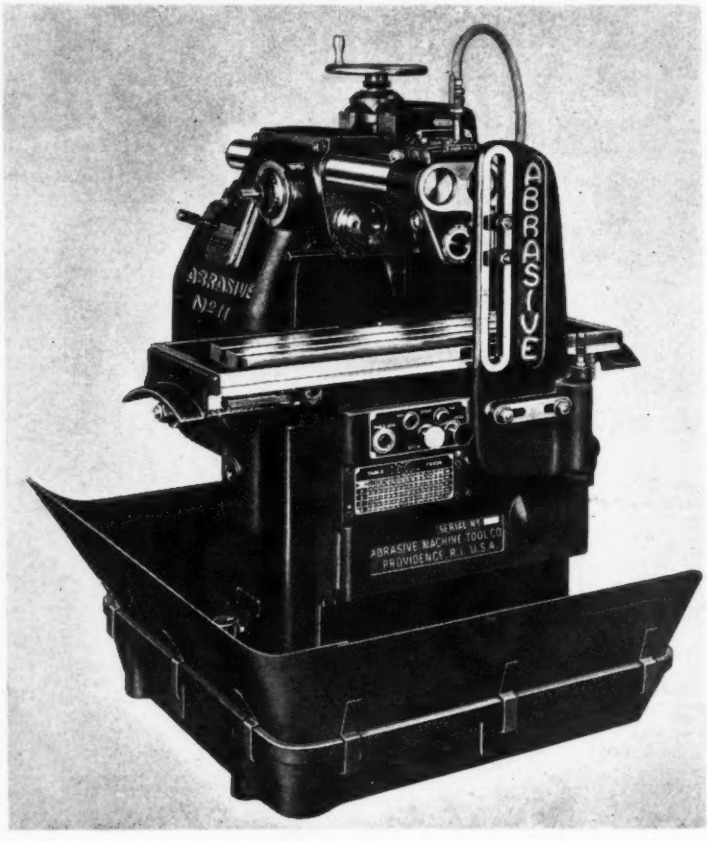
Used as an automatic sorter consisting of modulated oscillator and relay, the Cyclograph will sort metal parts according to one of the following characteristics, if all other variables are reasonably constant: Analysis, heat-treatment, structure, size, wall thickness of tubing, thickness of plating or cladding, magnetic or non-magnetic.

As a metal locator, the Cyclograph will detecf the presence of any metal in non-metallic material with a sensitivity depending upon the mass of the metal particles. 58

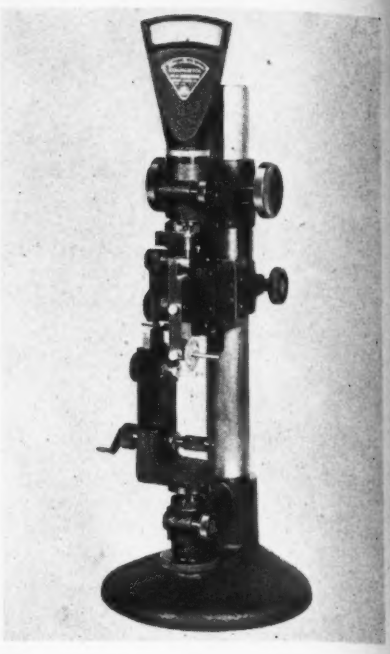
Manufacturing Type Plain Milling Machine

The Abrasive Machine Tool Co., East Providence, R. I., has just placed on the market a plain milling machine known as the B-11. This manufacturing type unit, with complete electrical control for table and spindle power movements, has ample capacity for most work of medium size, and has been designed to meet all ordinary requirements for production milling.

The machine has a built-in backlash eliminator on the table feed-screw which is released automatically during the fast travel movement. This permits climb-milling in either direction up to the capacity of the driving motors. Table movement can be changed quickly by means of the electrical controls. Other features include automatic reverse, fast table travel of 300 inches per minute, and an unusually wide selection of feeds and speeds. Safety features protect both operator and machine. 59



Plain Type Production Milling Machine Brought Out by the Abrasive Machine Tool Co.



Comparitol Gear Tester Developed by the George Scherr Co., Inc.

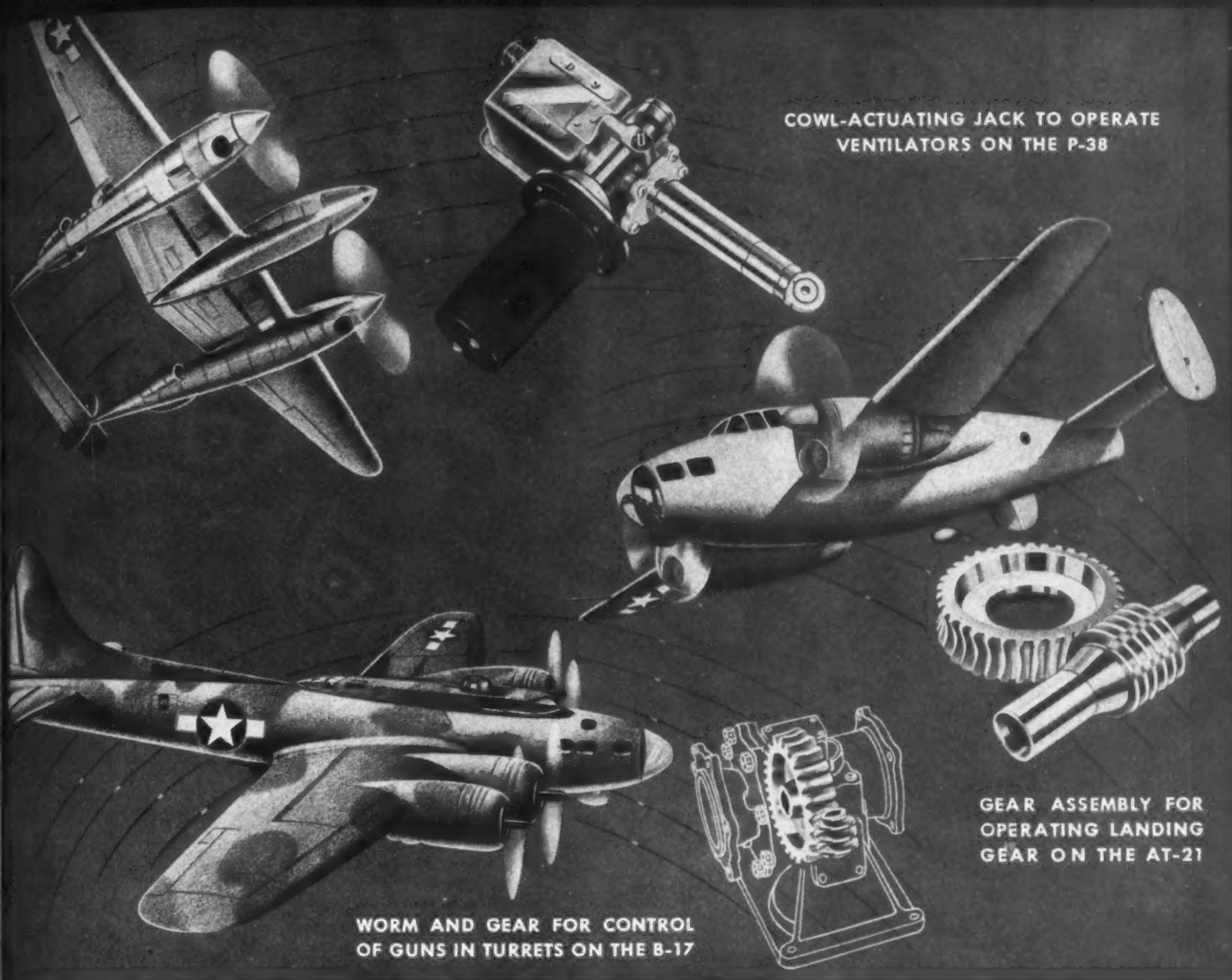
Scherr Comparitol Gear Testers

A gear tester that is designed to detect and locate faults during the manufacturing process and to check the accuracy of finished gears, has just been developed by the George Scherr Co., Inc., 126 Lafayette St., New York 13, N. Y.

The instrument is of vertical construction, occupies little bench space, and can be readily transported where required. It employs the highly sensitive and accurate Comparitol head mechanism used on the standard type Comparitol made by this company.

The center distance can be quickly checked by setting up the instrument to the proper distance with gage-blocks or other measuring standards. Beneath the gear under inspection appears a handle with a pinion, which the operator uses to rotate the gears. Any error is shown quickly by the comparator head, which permits reading to 0.0025, 0.001, 0.0005, or 0.0001 inch as desired, depending upon the class of work and the precision required. The gear tester will show irregularities in the rolling action between two working gears or gear and pinion. It will also show eccentricity of gears if any is present, and makes readily discernible any variation in gear tooth thickness. The instrument may be used to check gear train assemblies for

To obtain additional information on equipment described on this page, see lower part of page 196.



Production of Precision Aircraft Devices

SOLVING intricate production problems called for in the manufacture of high-precision aircraft devices is another contribution Foote Bros. Gear and Machine Corporation is making toward speeding the day of Victory.

Precision gears for reducers for azimuth and elevation control of guns in turrets in the B-17 bombers—gear assemblies to raise and lower the landing gear of the AT-21 trainers—cowl actuating jacks to operate ventilators on oil coolers on P-38 interceptors—all these devices call for light weight coupled with extreme precision.

Foote Bros. engineering experience and manufacturing "know-how" acquired in the production of precision gears in tremendous quantities for Pratt & Whitney aircraft engines assure the production of these special devices in the quantities required to meet the ever-increasing demand of our global air force.

It is natural that many manufacturers of airplanes, airplane engines and airplane parts recognize in Foote Bros. a logical source for gears and devices where light weight and extreme precision are essential.

After the war, the experience gained in the manufacture of such gears and devices promises American manufacturers a new era in the economical transmission of power.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois

ARMY E NAVY

FOOTE BROS.

Better Power Transmission Through Better Gears

run-out caused by faulty assembly of the gears.

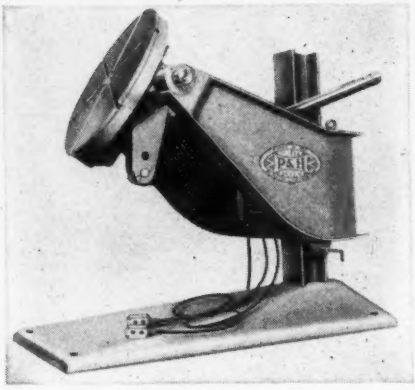
The tester has a range of 1 to 6 inches center distance, and special attachments are available that enable the inspector to check down to the smallest center distance in highly precise gears. 60

Immersed Type Motor-Driven Gusher Pump

A new immersed type motor-driven gusher pump has been developed by the Ruthman Machinery Co., 1819 Reading Road, Cincinnati, Ohio. This pump is equipped with an integral flange bracket for reservoir cover or bed-plate mounting, and is known as Model No. 9040. It is designed for installation interchangeability with the Model 1-P3 gusher pump, and is available for 25-cycle, one-, two-, or three-phase currents.

The 1/4-H.P. operating motor is full ball-bearing equipped, totally enclosed, with a one-piece rigid shaft which extends to the pump impeller. The new pump is made in two lengths, the distance from the mounting flange to the bottom of the pump being 6 7/16 and 8 7/16 inches. The pump can be had with a discharge outlet of either 1/2 or 3/4 inch. 61

Ruthman Immersed Type Motor-driven Gusher Pump



P & H Push-button Controlled Welding Positioner

P & H Welding Positioners

A newly designed line of welding positioners has been introduced by the Welder Division of the Harnischfeger Corporation, Milwaukee 14, Wis. This line of work-positioners has been developed to increase the efficiency of welding production lines by providing a positioner of greater flexibility and one that is easier to operate.

An outstanding feature is the dual capacity rating of each model. For example, the WP-6 in the 6000-pound class handles loads up to 6000 pounds maximum, and also has a secondary capacity of 9000 pounds maximum. Standard models are being made in dual capacities up to 24,000 pounds. The self-locking worm-gear and spindle drive of the tilting motion prevents upsets. A limit switch and adjustable stop brackets provide additional protection when extreme tilting is necessary.

The table can be quickly removed for bolting special fixtures directly to the bull gear. Remote control with individual magnetic push-button stations control two separate motors for tilting and turning the table. 62

Sheffield Instrument for Precision Measurement of Internal and External Dimensions

An entirely new kind of instrument for precision measuring of both internal and external dimensions that must be held to very close tolerances has been developed by the Sheffield Corporation, Dayton 1, Ohio. Several unusual features have been incorporated in this instrument to obtain a higher degree of accuracy, utility, and convenience. It can be used as an internal dimension comparator for checking master and working ring gages, for setting snap and length gages, and for other similar high precision work. It will check diameters or other internal dimensions from 3/4 inch to 12 inches, and depth of holes up to 3 inches. An open hole can be checked to a depth of 3 inches from one side, the piece turned over, and an additional check to a depth of 3 inches made from the other side. Taper, bell-mouth, and out-of-round conditions can thus be detected and measured. When used as an external comparator, it will check round, straight, and tapered work within a maximum length of 12 inches.

The gaging arms are raised and lowered by an electrical mechanism operated by two push-buttons. Automatic stops prevent the arms from being raised or lowered beyond the 3-inch range limits. A direct reading visual counter, graduated in hundredths of an inch, serves as an automatic height indicator, showing at all times the

Precision Instrument for Measuring Internal and External Dimensions

To obtain additional information on equipment described on this page, see lower part of page 196.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

U.S.A. BOMBARDIER'S VIEW OF AN ENEMY SHIP

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Let Bombsights Help You Choose Your Cutting Fluids!

A LEADING MAKER *of U.S.A.'s bombsight uses Socony-Vacuum Cutting and Soluble Oils on all cutting operations.*

When it comes to combining need for production with need for precision, it would be hard to find a tougher job than making finely machined American bombsights.

The fact that Socony-Vacuum Cutting Fluids are used on tough alloy steels in this job is an important indication of the performance you can expect from these high quality products. Use them to secure fast-cutting, long tool life, superior finish, maximum production.

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC.— Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of Calif.

CALL IN SOCONY-VACUUM

height of the gaging arms above the lapped table surface.

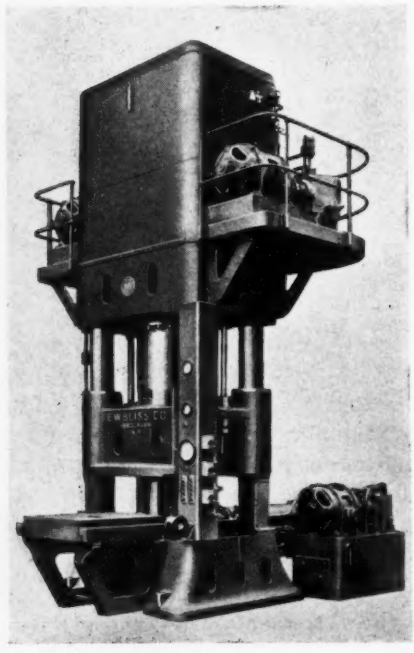
The electric gaging head provides a new and different type of electrical magnification of 2500 to 1. The scale of the "Electrigage" has a range of 0.0012 inch and is graduated in fifty-millionths of an inch (0.000050 inch). These graduations are spaced far enough apart so that interpolated readings of approximately 0.0000125 inch are possible. 63

Bliss Ejector-Equipped Hydraulic Forging Press

A 1100-ton self-contained hydraulic forging press equipped with a 35-ton ejector and a sliding die table has been developed by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn 32, N. Y. This press is electrically controlled, and interlocked by means of this control so that the press, die slide and ejector operations can only occur when the different members are in their proper positions. The 150-H.P. pumping unit installed on this press provides speeds as follows: Quick advance at 750 inches per minute; pressing at 37 inches per minute; and return at 725 inches per minute. Equipment with faster speeds is available if required.

Four methods of operation include semi-automatic cycle operation; full-automatic operation; jogging control by means of a drum type switch; and inching control. Semi-automatic cycle and full-automatic operation may also include operation of the die slide and ejector.

The universal control features of this press have been in use for over two years on presses engaged in the manufacture of aluminum billets and aluminum drop-forgings. These presses are available in capacities up to 1500 tons. 64



Bliss Hydraulic Forging Press

DeWalt Foundry Metal-Cutting and Tube-Cutting Machines

The DeWalt Products Corporation, Lancaster, Pa., has just brought out a foundry metal-cutting machine and a tube-cutting machine. The foundry metal-cutting machine, shown in Fig. 1, is designed for cutting gates and risers from castings of non-ferrous metals and alloys. With this machine, the operator can make cuts from any angle, since the arm carrying the 10-H.P. motor and roller-head assembly can be rotated right or left through a full circle of 360 degrees and the motor can be positioned at any point on the arm. The arm can be rigidly locked at any angle desired, and the motor can be held in any position along the arm by the chain-feed control.

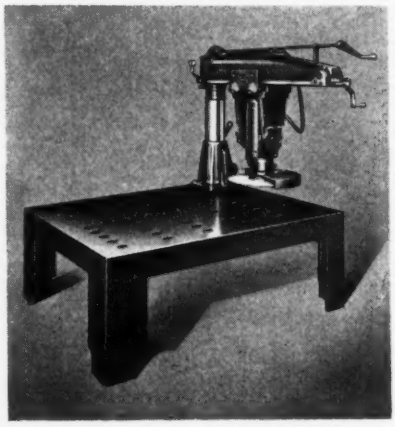


Fig. 1. DeWalt Foundry Metal-cutting Machine

Cuts are made by locking the arm in position and driving the cutting wheel by use of the chain feed through the riser, or the motor can be held in position and the cut made by moving the arm. The cut can also be made by a combination of both movements. For castings that are too large to be mounted on the table, the arm is simply moved to the right to clear the table and the cutting wheel either raised or lowered to the desired height. In this manner, the cut can be taken with the work resting on the floor, thus eliminating lifting of heavy materials. The cutting wheel can be lowered to within 20 3/4 inches of the floor and raised to a height of 27 3/4 inches above the floor.

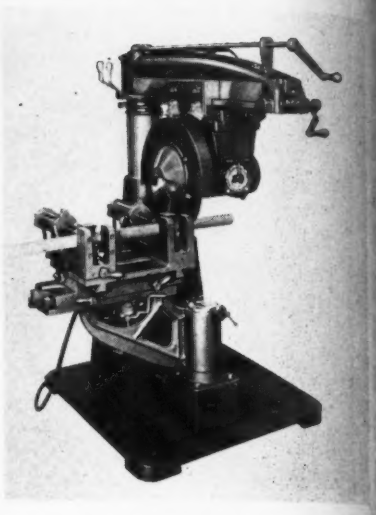


Fig. 2. DeWalt Tube-cutting Machine

The maximum movement of the column in the base is 17 inches. The length of travel of the head on the arm is 26 inches. Cutting saw blades or abrasive wheels 18 inches in diameter are supplied as standard equipment with suitable guards. Cutters 20 inches in diameter can, however, be supplied. The arbor diameter for abrasive wheels is 1 1/4 inches. The machine requires a floor space of 48 by 60 inches, and weighs approximately 2100 pounds.

The tube-cutting machine, shown in Fig. 2, will cut tubing, bars, and formed or extruded shapes in both ferrous and non-ferrous metals. For cutting formed sections, friction type saw blades are used. Abrasive wheels perform a better job on heavier sections and are recommended for use in cutting solid bars. Sections up to 4 inches can be held in the air-operated vise. Solids up to 1 1/2 inches in diameter are cut with abrasive wheels. The cutting capacity of the machine can be increased by developing suitable cutting tools. The control and angular adjustments of the

To obtain additional information on equipment described on this page, see lower part of page 196.

MACHINERY'S DATA SHEETS 501 and 502

DIAMETERS, AREAS, AND TAP DRILL SIZES—AMERICAN STANDARD SCREW THREADS

Size, No. or Diam.	Threads per Inch	Outside Diam., Inches	Root Diam., Inches	Tap Drill Size	Area, Square Inches, at Outside Diam.	Area, Square Inches, at Root Diam	Size, No. or Diam.	Threads per Inch	Outside Diam., Inches	Root Diam., Inches	Tap Drill Size	Area, Square Inches, at Outside Diam.	Area, Square Inches, at Root Diam.
0	80	0.060	0.0438	3/64	0.003	0.0015	9/16	12	0.5625	0.4542	31/64	0.248	0.1620
1	64	0.073	0.0527	53	0.004	0.0022	9/16	18	0.5625	0.4903	33/64	0.248	0.1888
1	72	0.073	0.0550	53	0.004	0.0024	5/8	11	0.625	0.5069	17/32	0.307	0.2018
2	56	0.086	0.0628	50	0.006	0.0031	5/8	18	0.625	0.5528	37/64	0.307	0.2400
2	64	0.086	0.0657	50	0.006	0.0034	3/4	10	0.750	0.6201	21/32	0.442	0.3020
3	48	0.099	0.0719	47	0.008	0.0041	3/4	16	0.750	0.6688	11/16	0.442	0.3513
3	56	0.099	0.0758	45	0.008	0.0045	7/8	9	0.875	0.7307	49/64	0.601	0.4193
4	40	0.112	0.0795	43	0.010	0.0050	7/8	14	0.875	0.7822	13/16	0.601	0.4805
4	48	0.112	0.0849	42	0.010	0.0057	1	8	1.000	0.8376	7/8	0.785	0.5510
5	40	0.125	0.0925	38	0.012	0.0067	1	14	1.000	0.9072	15/16	0.785	0.6464
5	44	0.125	0.0955	37	0.012	0.0072	1 1/8	7	1.125	0.9394	63/64	0.994	0.6931
6	32	0.138	0.0974	36	0.015	0.0075	1 1/8	12	1.125	1.0168	1 3/64	0.994	0.8118
6	40	0.138	0.1055	33	0.015	0.0087	1 1/4	7	1.250	1.0644	1 7/64	1.227	0.8898
8	32	0.164	0.1234	29	0.021	0.0120	1 1/4	12	1.250	1.1418	1 11/64	1.227	1.0238
8	36	0.164	0.1279	29	0.021	0.0128	1 3/8	6	1.375	1.1585	1 7/32	1.485	1.0541
10	24	0.190	0.1359	25	0.028	0.0145	1 3/8	12	1.375	1.2668	1 19/64	1.485	1.2602
10	32	0.190	0.1494	21	0.028	0.0175	1 1/2	6	1.500	1.2835	1 11/32	1.767	1.2938
12	24	0.216	0.1619	16	0.037	0.0206	1 1/2	12	1.500	1.3918	1 27/64	1.767	1.5212
12	28	0.216	0.1696	14	0.037	0.0226	1 3/4	5	1.750	1.4902	1 9/16	2.405	1.7441
1/4	20	0.250	0.1850	7	0.049	0.0269	2	4 1/2	2.000	1.7113	1 25/32	3.142	2.3001
1/4	28	0.250	0.2036	3	0.049	0.0326	2 1/4	4 1/2	2.250	1.9613	2 1/32	3.976	3.0212
5/16	18	0.3125	0.2403	F	0.076	0.0454	2 1/2	4	2.500	2.1752	2 1/4	4.909	3.7161
5/16	24	0.3125	0.2584	I	0.076	0.0524	2 3/4	4	2.750	2.4252	2 1/2	5.940	4.6194
3/8	16	0.375	0.2938	5/16	0.110	0.0678	3	4	3.000	2.6752	2 3/4	7.069	5.6209
3/8	24	0.375	0.3209	Q	0.110	0.0809	3 1/4	4	3.250	2.9252	3	8.296	6.7205
7/16	14	0.4375	0.3447	U	0.150	0.0933	3 1/2	4	3.500	3.1752	3 1/4	9.621	7.9183
7/16	20	0.4375	0.3726	25/64	0.150	0.1090	3 3/4	4	3.750	3.4252	3 1/2	11.045	9.2143
1/2	13	0.500	0.4001	27/64	0.196	0.1257	4	4	4.000	3.6752	3 3/4	12.566	10.6084
1/2	20	0.500	0.4351	29/64	0.196	0.1486	—	—	—	—	—	—	—

MACHINERY'S Data Sheet 501, November, 1943 Compiled by H. R. Teegarden and C. F. Crisafulli

SECTION MODULUS FOR RECTANGLES AND FOR ROUNDS UNDER 1 INCH DIAMETER

Section Modulus of Rectangles 1 Inch Wide

To obtain section modulus for rectangle of given length *L*, multiply value shown below by given width.

L	Sec. Mod.	L	Sec. Mod.	L	Sec. Mod.	L	Sec. Mod.
1/8	0.0026	2 3/4	1.26	12	24.00	25	104.2
3/16	0.0059	3	1.50	12 1/2	26.04	26	112.7
1/4	0.0104	3 1/4	1.76	13	28.17	27	121.5
5/16	0.0163	3 1/2	2.04	13 1/2	30.38	28	130.7
3/8	0.0234	3 3/4	2.34	14	32.67	29	140.2
7/16	0.032	4	2.67	14 1/2	35.04	30	150
1/2	0.042	4 1/2	3.38	15	37.5	32	171
5/8	0.065	5	4.17	15 1/2	40.0	34	193
3/4	0.094	5 1/2	5.04	16	42.7	36	216
7/8	0.128	6	6.00	16 1/2	45.4	38	241
1	0.167	6 1/2	7.04	17	48.2	40	267
1 1/8	0.211	7	8.17	17 1/2	51.0	42	294
1 1/4	0.260	7 1/2	9.38	18	54.0	44	323
1 3/8	0.315	8	10.67	18 1/2	57.0	46	353
1 1/2	0.375	8 1/2	12.04	19	60.2	48	384
1 5/8	0.440	9	13.50	19 1/2	63.4	50	417
1 3/4	0.510	9 1/2	15.04	20	66.7	52	451
1 7/8	0.586	10	16.67	21	73.5	54	486
2	0.67	10 1/2	18.38	22	80.7	56	523
2 1/4	0.84	11	20.17	23	88.2	58	561
2 1/2	1.04	11 1/2	22.04	24	96.0	60	600

Section Modulus of Rounds Under 1 Inch Diameter

Diam.	Sec. Mod.	Diam.	Sec. Mod.	Diam.	Sec. Mod.
1/64	0.00000037	11/32	0.00398	43/64	0.0297
1/32	0.0000030	23/64	0.0045	11/16	0.0318
3/64	0.0000101	3/8	0.0052	45/64	0.0341
1/16	0.0000239	25/64	0.0058	23/32	0.0364
5/64	0.0000467	13/32	0.0066	47/64	0.0388
3/32	0.00008	27/64	0.0074	3/4	0.0413
7/64	0.00013	7/16	0.0082	49/64	0.0440
1/8	0.00019	29/64	0.0091	25/32	0.0467
9/64	0.00027	15/32	0.0101	51/64	0.0496
5/32	0.00037	31/64	0.0111	13/16	0.0526
11/64	0.00050	1/2	0.0123	53/64	0.0557
3/16	0.00065	33/64	0.0134	27/32	0.0588
13/64	0.00082	17/32	0.0147	55/64	0.0622
7/32	0.00102	35/64	0.0160	7/8	0.0656
15/64	0.00126	9/16	0.0174	57/64	0.0692
1/4	0.00153	37/64	0.0189	29/32	0.0728
17/64	0.00183	19/32	0.0205	59/64	0.0767
9/32	0.00218	39/64	0.0222	15/16	0.0807
19/64	0.00256	5/8	0.0239	61/64	0.0849
5/16	0.00299	41/64	0.0258	31/32	0.0891
21/64	0.00344	21/32	0.0277	63/64	0.0934

MACHINERY'S Data Sheet 502, November, 1943 Compiled by H. R. Teegarden and C. F. Crisafulli

rotating arm and motor yoke assembly of this tube-cutting machine are similar to those of the metal-cutting machine described at the beginning of this article and shown in Fig. 1.

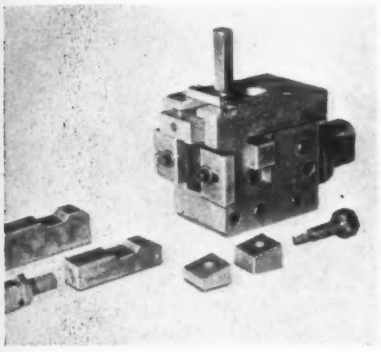
The tube-cutting machine, however, is equipped with a rotating vise assembly which is so designed as to permit rotating the entire assembly in a 300-degree arc around the vise column. The movement of the roller head and cutter is controlled by a crank through a chain and sprocket. When equipped with a 10-H.P. motor, the cutting wheel has a speed of 3450 R.P.M.; with a 5-H.P. motor, the cutting wheel speed is 1800 R.P.M. This machine uses saw blades or abrasive wheels up to 16 inches in diameter. It occupies a floor space of 56 by 56 inches, and weighs approximately 2100 pounds. 65

Pull Type Head for Keyway Broach

A new type keyway broach pull-head, designated as No. 1, has been developed by the American Broach & Machine Co., Ann Arbor, Mich. Although designed primarily for pulling keyway broaches of practically all sizes, this puller can also be utilized for pulling rectangular or oval broaches, or broaches of any other shape. The pull-head can be manually or automatically operated, depending upon the work and whether or not the broach must be disconnected between cuts. When automatic operation is desired, it is only necessary to attach a threaded stud to the sliding member of the head. Since it is only necessary to slide the broach into the new pull-head the possibility of injury to the operator is practically eliminated.

Use of this pull-head is claimed to reduce broach breakage, especially in the case of the smaller sizes of broaches. In using this pull-head, it is not necessary to discard broaches having the old type threaded shank section. An adapter, such as shown in the foreground of the illustration, can be attached to the end of the broach and held securely by a locking nut. The broach can then be utilized in the new type holder. When new keyway broaches are ordered they can be purchased with a notched type shank for the new pull-head.

Each broach head is furnished with a set of adapters. Two extra cams for adjusting the head for various sized shanks, centering gates on the front of the head, and four riser plates which can be placed in the head below the broach in making suitable adjustment for various types of shanks are also provided. 66

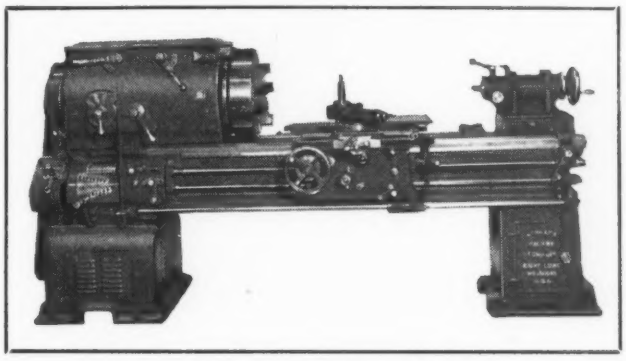


Pull-head for Broach Developed by American Broach & Machine Co.

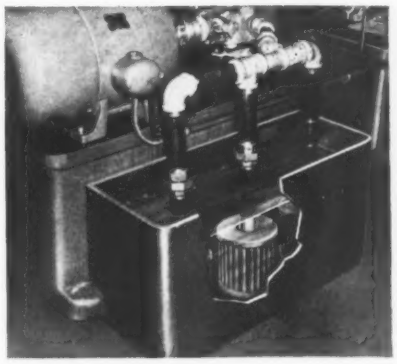
Lehmann Hydratrol Hollow-Spindle Lathe

The Lehmann Machine Co., Chouteau at Grand, St. Louis 3, Mo., has recently added to its line of "Hydratrol" large hollow-spindle lathes an 18-inch lathe with a 7 1/8-inch hole in the spindle. This line of lathes now covers a range of sizes from 18 to 36 inches.

All the lathes in this line have been designed for easy, fast, and simple operation. Hydraulic brakes and clutches; automatic lubrication; mechanisms protected by automatic control; bed of unusual hardness; and other improved features have been incorporated in the machines of this line. 67



Lehmann Hydratrol Lathe Added to Large Hollow-spindle Line



Staynew Radial Fin Sump Type Filter

Staynew Radial Fin Sump Type Liquid Filter

A new sump type liquid filter designed for use where dirty liquids are collected, filtered, and recirculated has been brought out by the Staynew Filter Corporation, 11 Centre Park, Rochester 4, N. Y. This filter—the Model SE—is designed to meet the demand for a compact, simplified, efficient filtering unit that can be mounted on the end of pump suction lines and completely submerged in the settling basin or sump from which the liquid is to be pumped.

This type of installation protects the pump from abrasive particles which cause rapid wear, and at the same time, provides clean liquid. Actual installations under varied conditions have proved its effectiveness in handling liquids of relatively high viscosity carrying heavy concentrations of metallic cuttings, abrasives, sludge, etc. It is particularly adapted for filtering sulphurized and straight mineral oils and water soluble oils which are commonly used as coolants.

The filter insert material is preformed in a radial fin shape and slips over a heavy similarly shaped mesh supporting

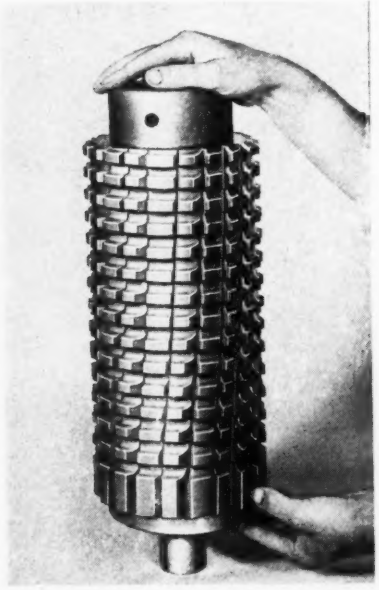
To obtain additional information on equipment described on this page, see lower part of page 196.

form. This design permits expansion of the insert like a bellows, so that accumulated material can be easily washed or brushed off to restore the filter to its original condition in a few minutes. This filter is regularly made in seven models with capacities ranging from 2.5 to 28.0 gallons per minute. 68

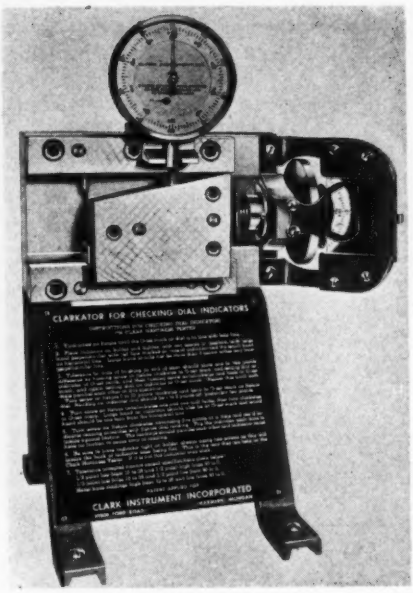
Multiple Thread-Milling Cutter

One of the largest multiple thread-milling cutters ever produced is being introduced on the market by the Plan-O-Mill Corporation, 1511 E. Eight Mile Road, Hazel Park, Mich., for threading work such as gun tubes, breechblocks, and other internally and externally threaded parts up to 16 inches in diameter. The cutter is 12 3/4 inches long, 6 1/2 inches in diameter, and takes a "Higbee" cut which removes the imperfect thread.

The difficulty previously experienced in producing a cutter forging of such large size with the necessary uniform hardness was overcome by the Plan-O-Mill engineers by developing the segmental cutter design employed. This has the further advantage of providing a spiral gash-cutting action which results in smoother milling and improved work finish. In threading large tubes, these cutters are used for rough, semi-finish, and finish cuts. 69



Plan-O-Mill Multiple Thread-milling Cutter



Device for Checking Accuracy of Dial Indicator

"Clarkator" for Checking Accuracy of Dial Indicator

A new device for checking the accuracy of dial indicators is announced by Clark Instrument, Inc., 10200 Ford Road, Dearborn, Mich. This device, called the "Clarkator," employs the sine bar principle, checking against the tangent of the angle. The indicator to be tested is mounted on the top of the device with its spindle resting on a lapped angle-block, which is advanced or withdrawn by an adjusting screw. After clamping the indicator in position with its zero reading coinciding with that of the dial face on the Clarkator, the screw is revolved in either direction to check other indicator readings. Reading of the Clarkator dial is by means of a mirror, which enables it to be viewed in such a manner that it can be easily compared with the indicator reading.

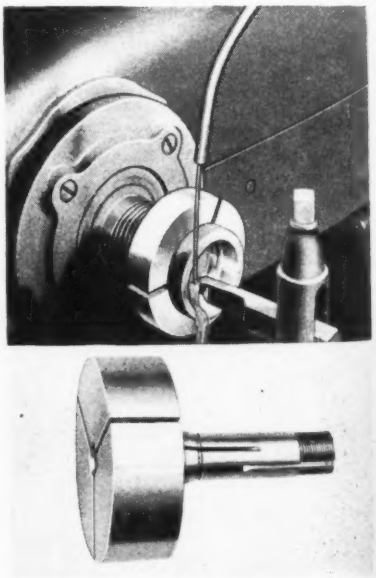
The Clarkator is said to be suitable for periodic inspection both of the direct-reading indicators and the reversed-reading indicators used on Rockwell hardness testers. The front angle is used when checking standard indicators, each revolution of the adjusting screw representing a movement of 0.020 inch, while each point on the dial represents a movement of 0.0002 inch. The back angle provides a direct method of checking hardness-tester indicators by using the adjusting screw. 70

Collet Chuck for Second-Operation Work

A step collet known as the G-B-M universal collet chuck, designed especially for second-operation work, is being introduced on the market by the Gilbert-Baker-Midlam Co., 38 N. Jefferson St., Dayton 2, Ohio. This new chuck has a tapered shoulder that fits the closing sleeve in the lathe spindle and is operated by the usual lathe draw-in collet attachment, a threaded shank being engaged by the draw-bar.

The shank and tapered shoulder are hardened, but the head, which is 3 inches in diameter, is made of cold-rolled steel. With the collet chuck held in the lathe, a recess is bored in the head the size of the work to be held. The bored arcs of the three head segments form the jaws of the chuck, which grip the work when the draw-bar pulls the tapered shoulder against the closing sleeve. Since the work recess is bored on the same set-up as succeeding production operations, all work can thereafter be chucked concentrically without employing an indicator for each piece.

This chuck will handle work from 1/2 inch to 2 3/4 inches in diameter. The thickness of the chuck head permits its use for a number of different jobs by boring each recess to a greater depth than the succeeding one of larger diameter. While especially suitable for



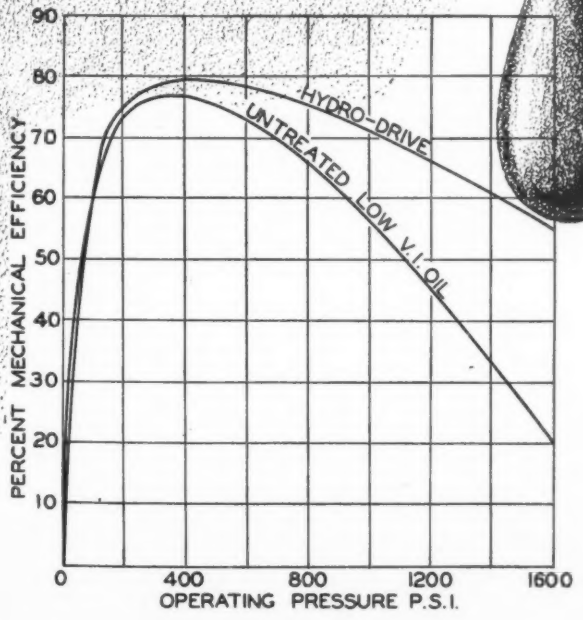
G-B-M Universal Collet Chuck for Second-operation Work

To obtain additional information on equipment described on this page, see lower part of page 196.

Proving that a Hydraulic Oil with

HIGH V.I.

Means Increased Production



Look at the graph if you have any doubt as to the importance of Viscosity Index rating of a hydraulic oil.

With a sump temperature of 160°F., which is not unusual, an untreated oil falls off rapidly in efficiency as operating pressures exceed 500 psi. But Hydro-Drive, with its high V.I., holds its efficiency to a greatly improved degree over ordinary hydraulic oil. An efficiency rating of only 21% means lost production, there being the same power input on the hydraulic pump under test.

High Viscosity Index is, of course, not the only property a good hydraulic oil must possess. As important is stability against oxidation or chemical change . . . also the ability to hold gums and resins in suspension rather than allow them to be deposited on metal surfaces. The treatment given Hydro-Drive provides this solvent ability.

Put these three essential factors together in one oil, and you have quality and long life. Why not ask the Houghton Man?

E. F. HOUGHTON & CO.
PHILADELPHIA
and all principal cities in the United States and Canada.

Houghton's HYDRO-DRIVE

10-inch Atlas lathes and Logan lathes, these chucks are made to fit the collet attachments of practically any lathe, and are also applicable to most milling machines using draw-in collets. 71

Speed Lathe with Collet Chuck

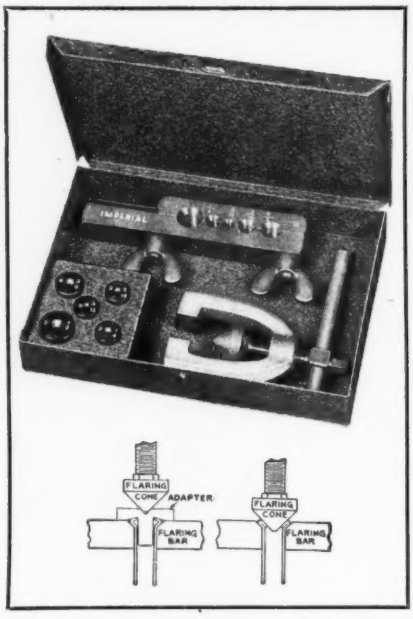
The Standard Electrical Tool Co., Department C-3 2489 River Road, Cincinnati, Ohio, has just brought out a speed lathe of double-end construction which permits two operators to work at the same time and thus conserve floor space. Each operator can work independently of the other, as the construction provides for a combination clutch and brake which permits both sides of the machine to be controlled independently. The motor is of 1 H.P., and is individually controlled by a toggle switch.

The illustration shows the right-hand side of the machine equipped with a Sjogren collet chuck, while the left-hand side is furnished with a 4-inch universal lathe chuck. This lathe is also available as a single-end machine in sizes of 1/2, 1, and 2 H.P., with any spindle speed from 50 R.P.M. to 3450 R.P.M. It is also made in a bench model with foot control. 72

Speed Lathe Made by the Standard Electrical Tool Co.

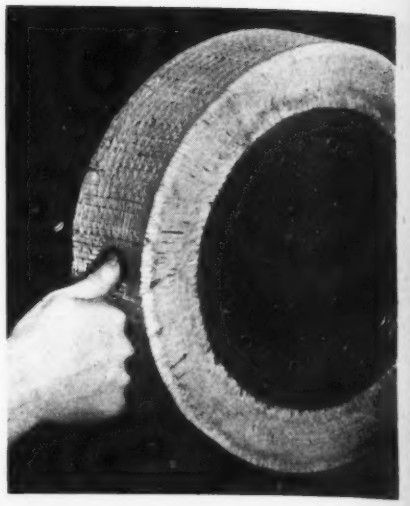
Double-Thick Flaring Tool for Steel Tubing

A new flaring tool designed to produce correctly formed double-thickness flares on all commonly used sizes of thin-walled steel tubing from 3/16 to 1/2 inch for SAE flare and inverted flare joints has been brought out by the Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7, Ill. The tool can also be used for making single or double flares on copper or aluminum tubing. Folding back the end to produce double-thick, double-strength walls insures against cracking.



Tube Flaring Tools Made by Imperial Brass Mfg. Co.

An important advantage of this tool is that it can be taken right to the job. It is small and convenient to use. No vise is required and no hammering is necessary. Flaring can be done in very close quarters. The tool is first used to bell the tubing, employing an adapter as shown in the lower left-hand corner of the illustration. The double flare, as shown to the right is then completed in much the same manner as a plain flare is made with the conventional type flaring tool. The tool can be used for flaring soft steel tubing of seamless, butt-welded, or lap-seam-welded construction having walls not over 0.035 inch thick. The complete tool consists of a flaring bar, yoke, and five adapters — all furnished in a metal box. 73



Segment-face Wheel Designed for Driving Abrasive Backstand Belts

Segment-Face Contact Wheel for Driving Abrasive Belt

A new segment-face contact wheel designed to increase the range of work that can be finished with backstand idlers using abrasive belts has been developed and patented by the Minnesota Mining & Mfg. Co., St. Paul 6, Minn. This new wheel is so made as to combine a firm unyielding flat driving surface with a soft cushioned center. The flat unyielding surface of this new wheel is especially adapted for driving the abrasive belt, while the soft cushioned center permits the wheel to adapt itself to the contour of the part that is being ground.

The yielding characteristic of the cushioned center is indicated by the accompanying illustration. Under pressure of the thumb, the face of the wheel can be readily depressed, as shown. The wheels are available in three types—R for flat surfaces; H for minimum contours; and B for maximum contours.

Most grinding and polishing machines of conventional design can be readily equipped for abrasive-belt finishing. This is accomplished by simply mounting one of the new segment-face contact wheels on the machine spindle, installing a backstand idler at the rear of the machine, and placing an abrasive belt of the proper grade and size over the segment wheel on the machine and the idler wheel on the backstand. The advantages of an abrasive wheel of very large diameter with a flexible face are thus made available in grinding or finishing

To obtain additional information on equipment described on this page, see lower part of page 196.

Save BASIC TRAINING

(Photo by Office of War Information)

for Your Screw Driving Army

NO PRACTICE NEEDED TO DRIVE PHILLIPS SCREWS . . .

It's no problem to replace men who have left your screw driving army for the fighting front, *if you use Phillips Recessed Head Screws.* Anybody can "take over", without training, and do a good job!

The scientifically designed Phillips Recess makes screw driving fool-proof. It automatically centers the driving force and eliminates all driving troubles . . . fumbling, wobbly starts . . . slant-driven screws . . . burred and broken screw heads . . . and dangerous screw driver skids.

Screw and driver "become one unit", making such efficient use of turning power that driving is much easier and faster, regardless of driving method. And, power driving is made practical.

Compare the cost of driving Phillips and slotted head screws. You'll find that it actually costs less to have the advantages of the Phillips Recess!

PHILLIPS *Recessed Head* SCREWS

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

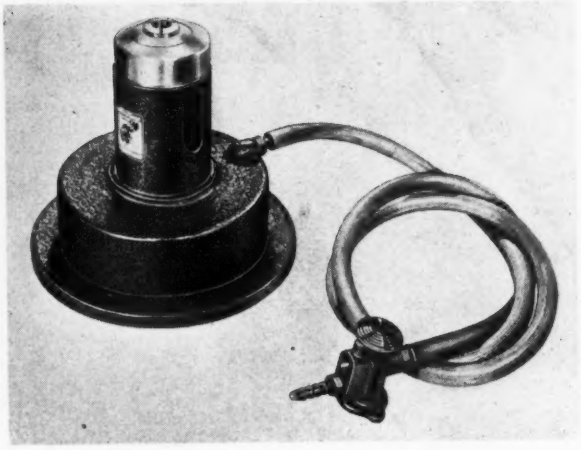
21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

work pressed against the belt where it passes over the yielding surface of the segment-face contact wheel. 74

Cemented-Carbide Rotary Files

Carbur, Inc., Lincoln Park 25, Mich., has recently added six new files to its line of cemented-carbide rotary files previously brought out in two ball-end types. The new files are available in three shapes, each of which is furnished in two sizes. All of these tools have cutting teeth ground from the solid, and because of their wear resistance are claimed to have a life at least fifty times that of high-speed steel tools of similar types. Since they provide a sharp cutting edge over a long period of time, they reduce the burring time per part. An important factor in the reduction of finishing time is the fact that these new tools can be run at much higher speeds than is possible with those made of steel. 75



Mead Air-operated Drilling and Milling Fixture

which contains an automatic ejecting mechanism, which is also air-operated. 76

Airflex Spinner Riveter with Pressure Pad

New models of the Airflex spinner riveters manufactured by the Airflex Equipment Co., 13255 Birwood, Detroit, Mich., are being equipped with an advance pressure pad. This equipment consists of an aluminum housing, spring, and pilot located in advance of the peening tool to hold the assembly rigidly against the rivet set. This eliminates fatiguing vibration and facilitates accurate work. Operating at high speed, the spinner riveter will produce round, oval, or flat heads on rivets; peen shafts, pins, and studs; and furl or swage shoulder bushings and light tubes to sheet metal or plastics.

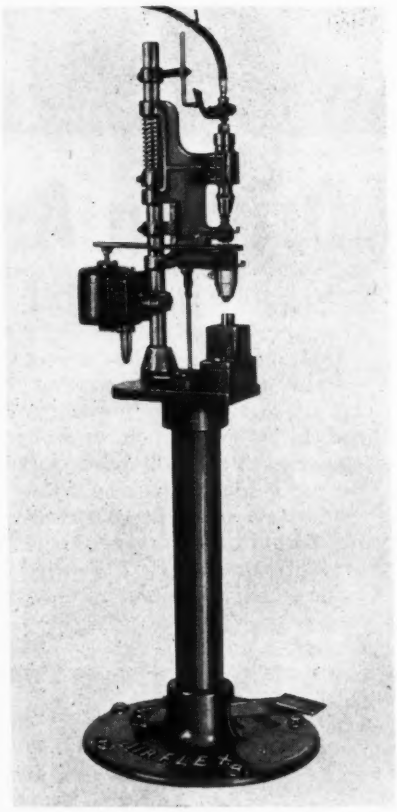
The force and frequency of the blows struck by the air-operated peening tool are regulated by an air valve, while the rotating motion of the tool is furnished by a 1/8-H.P., ball-bearing, push-button controlled motor.

The frame has a travel of about 2 inches and an adjustment on the post of 4 inches to accommodate assemblies of various sizes. The throat depth is 5 inches. This riveter can be supplied in three models having capacities of 5/32, 1/4, and 5/16 inch. 77

Mead Pneumatic Collet Fixture for Drilling and Milling Operations

A new precision pneumatic drilling and milling fixture known as Model C-18, designed to provide a powerful and accurate grip on round, hexagonal, or square work, is being manufactured by the Mead Specialties Co., 15 S. Market St., Chicago 6, Ill. This fixture has a maximum capacity for holding 1-inch round, 23/32-inch square, and 7/8-inch hexagonal pieces. An accurate depth stop is provided, consisting of a hollow ram through which a depth-gaging rod of the required length is passed.

The fixture is furnished with an adapter for connecting the ram to any standard draw-in collet of any capacity up to 1 inch. A corresponding closing ring is pressed into the top of the housing. The fixture is sealed, so that lubricants and coolants can be freely employed. An alternate housing is available with sealed openings that enable the oil to be pumped through the collet for washing away chips. A special base can be furnished



Airflex Spinner Riveter

Standardized Line of Thread Milling Cutters

In order to speed up delivery and simplify the ordering of multiple thread milling cutters, the Detroit Tap & Tool Co., 8432 Butler, Detroit 11, Mich., has developed a line of standardized thread milling cutters of the sizes and types in greatest demand. Blanks for these various sizes are now carried in stock finish-machined and heat-treated, ready for the finish-grinding of threads. Included in the line are both shell and shank type cutters. The diameter range of the forty different shell type standard blanks is from 1 1/2 to 3 1/2 inches. Twelve different shank type cutters are carried in stock, ranging from 3/4 inch to 1 1/2 inches in diameter.

In placing an order for these cutters, it is only necessary to give the blank number and thread specifications desired. The blanks are then taken from stock and the threads ground to specifications. 78

* * *

Absence makes the war grow longer.

To obtain additional information on equipment described on this page, see lower part of page 196.

BOTTLENECKS

DAMN THE ~~TORPEDOES~~

FULL SPEED AHEAD!

Making only Mounted Wheels and small Grinding Wheels—maintaining highest quality in spite of large quantities and rush orders—shipping them promptly. *This is our job, our battlefield.*

With full WPB approval, we stopped making all large size grinding wheels and fixed our sights on wheels *3″ in diameter and under.*

We worked all around the clock, 24 hours a day, and in a short time were able to fill orders on time—And, our central location cuts time in transit. Today, there is no waiting. With the Army-Navy E at our masthead, we are going full speed ahead.

AMERICA'S HEADQUARTERS FOR

MOUNTED WHEELS

Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

TEST WHEEL FREE—To get acquainted with Chicago Wheels, let us send one postpaid. Tell us size wheel and material you wish to grind.

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ARMY E NAVY

CHICAGO WHEEL & MFG. CO.

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MR-11.

Send Catalog. Interested in:

☐ Mounted Wheels ☐ Grinding Wheels ☐ Send Test Wheel. Size_____

Name _____

Address _____

Aid in Post-War Planning

The Bureau of Foreign and Domestic Commerce has published a 32-page booklet, 8 by 11 inches, entitled "Community Action for Post-War Jobs and Profits." The need for full employment after the war is thoroughly recognized by everyone. Industry must make plans now to meet this post-war problem. In an effort to aid manufacturers and business men in this work, the Department of Commerce has published this booklet, especially for moderate-sized communities.

The methods outlined in the book call for no outside supervision; they merely require aggressive local leadership by such organizations as the local Chamber of Commerce, and the active support of men engaged in business and industry. In the foreword to the booklet, the Department of Commerce expresses its belief and faith in the system of free enterprise.

Single copies can be obtained free of charge from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.; additional copies can be obtained at 15 cents each in lots of 100 or more from the Superintendent of Documents, Washington, D. C.

The Committee for Economic Development, Department of Commerce, of which Paul G. Hoffman, president of the Studebaker Corporation, is chairman, has published a 32-page booklet, 8 1/2 by 11 inches, entitled "Plan Post-War Jobs Now." This booklet contains suggestions to industrial employers, intended to aid them in achieving high levels of productive employment after the war. The publication contains a great deal of specific information and statistical data, and is well worth studying by every employer of labor.

National War Fund

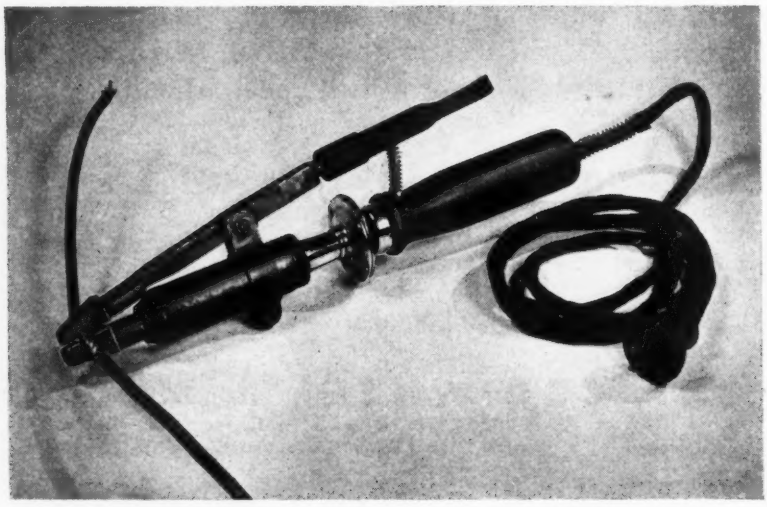
In order to raise funds for the USO and a number of other war relief service organizations, a campaign is being conducted throughout the nation with the cooperation of 6000 local organizations. The goal of the National War Fund is $125,000,000. This goal has been distributed on an equitable basis through quotas among the states and local communities. This National War Fund deserves everybody's support because of the purposes for which it will be used. The method of raising funds for all the war relief organizations at one time will eliminate much confusion in the minds of contributors who, in the past, have been faced with incessant and innumerable demands from a great many different organizations with worthy objectives, all of which are now included in this one fund.

* * *

Attachment that Facilitates Soldering Wire-to-Wire Cross Connections

A mechanic in the Switchgear Division of the Westinghouse Electric & Mfg. Co. recently made an attachment for an ordinary soldering iron which permits wire-to-wire cross connections to be soldered perfectly and much quicker than with the soldering iron alone.

The attachment, designed as shown in the accompanying illustration, supplies heat all around the twisted wires simultaneously, so that as the heat spreads along the wires, the solder can be applied directly to them. The attachment which, of course, is made of copper, permits more heat to be stored up while the iron is not being used, and thus has the advantage of making more heat available for the soldering operation. When it is desired to use the soldering iron in the usual way, the attachment can be removed with a screwdriver.



Attachment for Soldering Iron that Speeds up the Soldering of Wire-to-wire Cross Connections

Motor and Control Buying Data

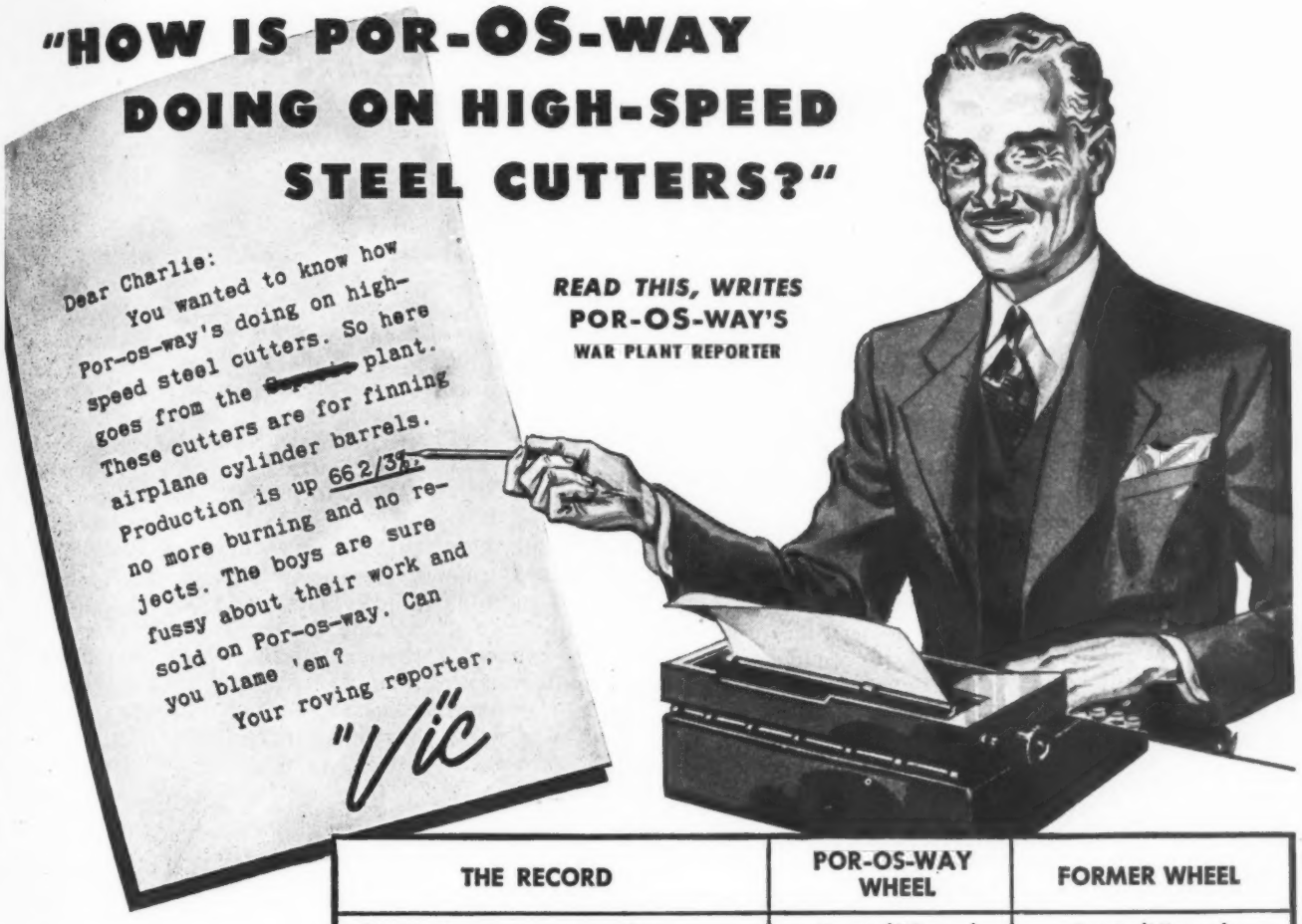
A 180-page book entitled "Motor Buying Data," covering electric motors up to 100 H.P., gearmotors, and motor-generator sets, has been published by the Westinghouse Electric & Mfg. Co. Another book, of 276 pages, "Control Buying Data," lists a wide variety of controls and accessories for direct-current, single-phase, squirrel-cage, and wound-rotor motors. The books are intended for large-scale buyers. Copies can be secured from the company's district offices only—not from the main Westinghouse offices at East Pittsburgh.

* * *

The Story of the Electron

In its publication *Backgrounds*, Pratt & Whitney, West Hartford, Conn., has included, as the leading feature, an instructive article, "The Electron—Key to the Future?" This article covers in clear, easily understandable language, many of the interesting facts pertaining to electrons. Another interesting section of the publication headed "Tales of a Trouble Shooter," relates how many difficulties in the operation of machine tools are due to overlooking simple precautions.

"HOW IS POR-OS-WAY DOING ON HIGH-SPEED STEEL CUTTERS?"



READ THIS, WRITES
POR-OS-WAY'S
WAR PLANT REPORTER

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Production per man per hour	5 sets (20 pcs.)	3 sets (12 pcs.)
Pieces per dressing	8 to 12	3
Wheel life	8 hours	6 hours
Stock to be removed	.010"—.018"	Same
Depth of cut per pass	.003"	.001"
Rejects	None	0.5 to 1%
Operations eliminated	Cutting shoulder	
Production Increase	66⅔%	
Remarks: Former wheel burned work. Por-os-way grinds cool, holds corner.		

THE JOB:
Grinding sets of Huther high-speed steel cutters for finning airplane cylinder barrels on a universal tool and cutter grinder.

THE WHEEL: Por-os-way 7"x½"x 1¼" 9A60HV2.

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent.

Write for complete booklet "Facts About Por-os-way". The address is 2[illegible] Wheatland Street, Phoenixville, Pennsylvania.

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY* *a new* RADIAC* PRODUCT

A. P. DE SANNO & SON, INC.
NEW YORK, CHICAGO, PITTSBURGH, CLEVELAND, DETROIT, LOS ANGELES

PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

*T. M. Reg. U. S. Pat. Off.

Recent Industrial Motion Pictures that Aid in Training Workers

Several interesting and instructive motion picture films have recently been produced by a number of industrial concerns, of value not only in training new workers, but also in keeping experienced men informed of new methods and techniques.

Automatic Thread Grinding

The Jones & Lamson Machine Co., Springfield, Vt., has produced a sound motion picture entitled "Thread Grinding—Fully Automatic." The film requires twenty-eight minutes to show, and constitutes an interesting and instructive demonstration of the setting up and operation of a fully automatic thread grinding machine. Animated portrayal has been used to show some of the more intricate functions of the machine. The film, therefore, is likely to interest mechanical men in general who wish to keep informed on this comparatively new technique of fully automatic production of precision ground threads. For circulation among educational institutions, trade schools, and associations, 16-millimeter prints are available on application to the Jones & Lamson Machine Co.

Dial Indicator Gages and Their Use

Two films relating to dial indicator gages and their use have been brought out by the Federal Products Corporation, Providence, R. I. The first film, which requires twenty minutes to show, explains in detail the principles of direct measuring and of precision measuring. It tells what tolerances are, how they are applied to mass production, and how dial indicators are used to check them. The dial indicator mechanism characteristics and its practical application are also explained.

The second film, which runs eighteen minutes, demonstrates how dial indicator gages are used to control the dimensions of interchangeable work. Direct-measuring dial indicator gages and gages for quickly sorting material for size are shown in use.

These films are not only instructive to apprentices and inexperienced men, but are of interest and value to experienced operators, inspectors, and tool engineers. The films are lent to institutions and firms who wish to show them, on request to the Federal Products Corporation. There is no charge for one-time showings, except return transportation of the film. Films desired for permanent use are available at cost.

Welding Stainless Steel

A third film, "Welding Stainless Steel," has been produced by the Allegheny Ludlum Steel Corporation. Its purpose is to serve as an aid in teaching fundamentals of stainless-steel welding to students, as well as to welders familiar with carbon-steel welding. This two-reel film, which takes about twenty-five minutes to show, will be sent without charge to companies, trade or technical groups, and industrial schools and colleges upon application to the Allegheny Ludlum Steel Corporation, Brackenridge, Pa.

Industrial Safety Goggles

A sound motion picture film entitled "Right on the Nose," which shows in detail the quickest and easiest methods of adjusting industrial safety goggles so that workers can wear them in comfort, is being distributed by the American Optical Co., Southbridge, Mass. This picture is believed to be the first of its kind. It is a 16-millimeter film, and takes fourteen minutes to show. The picture is available for loan or for purchase from the company. No charge is made for the loan of the film.

* * *

It is a matter of no less importance to see to it that, while the war is being won, America—the America we have known and our fighting men believe in—is not lost. That America *can* be lost. Even now I believe that only a great upsurge of national indignation and of a national demand for a return to representative, responsible government can save it.—*Harry F. Byrd, U. S. Senator from Virginia*

Industrial Facilities Owned by Government

According to figures recently compiled, it is expected that, at the end of the war, the Government will own about 10 per cent of the steel-making capacity of the country; more than half of the aluminum capacity; 92 per cent of the magnesium capacity; two-thirds of the synthetic rubber capacity; one-half of the machine tool building capacity; and 90 per cent of the aviation plants.

This indicates how important the Government's post-war policy with regard to its interest in industrial plant capacity is. It is to be hoped that this policy will be determined by experienced men in business and industry, and not by theorists who do not understand what it is that makes the wheels of industry turn. The situation that this nation faces at the end of the war is, if anything, more difficult to plan to meet than winning the war.

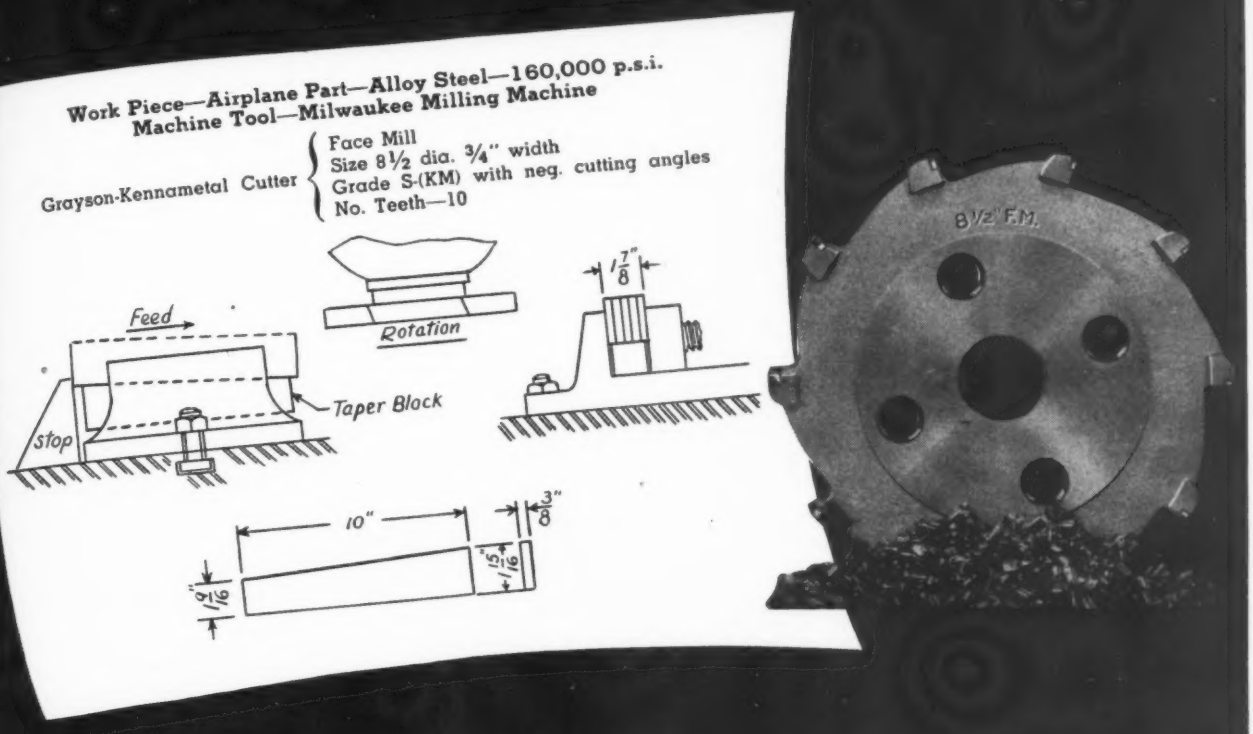
* * *

Do Union Rules Sabotage War Production?

Government officials who are worrying about the fact that war production is not increasing in proportion to the increasing manufacturing facilities of the country, and who realize that in Great Britain the output per man-hour is greater in many war production fields than it is in the United States, should read the article in the June, 1943, number of the *Reader's Digest* entitled "Remove Union Restrictions and Increase Shipyard Production by One-Third." This article begins with the statement "'Wipe out every union curb on work and we will build a third more ships with no more men,' said the manager of an Eastern shipyard." A Pacific Coast superintendent, according to the same article, said "If the unions would take off the brakes and let me go in high, we would double our output."

All the difficulties may not be with union rules, however. In the August number of the same magazine, there is a symposium entitled "What is Wrong with Management?" that deserves the consideration of all thoughtful managers.

3 HOURS



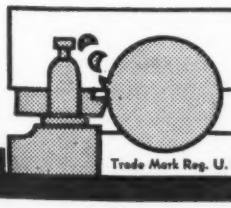
★Recently in an American airplane factory a GRAYSON-KENNAMETAL milling cutter was substituted for a High Speed Steel cutter. It removed as much steel in 3 hours as had previously required 3 days. Production was thus stepped up 500%!

The material milled was an alloy steel airplane part having a tensile strength of 160,000 p.s.i. The cutter, as illustrated, was a face mill, 8½" diameter, ¾" wide, 10 teeth, negative cutting angles, and grade KM carbide inserts. The following are data concerning the operation.

COMPARATIVE PERFORMANCE

	High Speed Steel	GRAYSON-KENNAMETAL Mill
No. teeth in cutter	14	10
Speed	61 RPM	136 RPM
Feed	⅝"/min.	7¼"/min.
Floor to floor time per load	21 min.	3½ min.
Pieces per hour	14.4	86

This outstanding performance is typical of the revolutionary results being achieved with GRAYSON-KENNAMETAL cutters (Meehanite bodies, Kennametal inserts). Write for complete information, or better still, call the nearest KENNAMETAL representative and let him demonstrate the milling improvements that can be effected in *your* shop.



KENNAMETAL *Inc.*

147 LLOYD AVE., LATROBE, PA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

Trade Mark Reg. U. S. Pat. Off.

KENNAMETAL THE *All American* CARBIDE

Ferracute Machine Co. Observes Eightieth Anniversary

The Ferracute Machine Co., Bridgeton, N. J., observed the eightieth anniversary of its founding on October 23. In this connection, the company has published a historical brochure which contains interesting information relating to the early days of the company and of the press industry as a whole. Unusual old pictures are reproduced. Those interested can obtain copies from the company.

The Ferracute Machine Co. was established in 1863 by the late Oberlin Smith. Beginning as a small machine shop, it grew to occupy an important position in the power press industry. During his lifetime, Mr. Smith obtained seventy-five patents, fifty-two of which were related to presses and dies; and in recognition of his achievements, he was elected president of the American Society of Mechanical Engineers. At the present time, practically all the company's facilities are devoted to the production of ammunition presses.

Free Mailing Privilege of Government Bureaus

The Burch Bill—H.R. 2001—introduced in Congress would, if passed, have a favorable effect on the postal service. According to the National Council on Business Mail, the bill provides for revoking the present privilege of Government bureaus and agencies to send unlimited quantities of material through the mails free. If the Burch Bill is passed, each bureau or agency will have to pay postage on its mailings. A study of the bill by the Council reveals that passage will have far-reaching influence.

Last year, this Government-bureau free mail amounted to nearly one-tenth of the total volume handled by the Post Office Department. If it had been paid for, it would have added $72,000,000 to the department's revenues, wiped out a $14,000,000 deficit, and left the department with a $58,000,000 profit. The volume of this mail has multiplied fivefold during the last ten years.

The operating profit that would result from enactment of the Burch measure could be used to block the designs of some Congressmen who are reported to be eyeing the Post Office Department as a source of new taxes through an increase in postal rates. With the department clearly "in the black," it might even be possible to reduce rates, in order to offer the public the most economical postal service possible.

The bill would also have other effects. Because it would require Government departments to set up a postage item in their budgets, greater discretion and some subsequent curtailment in the amount of the mail they send out could be expected. This would ease the load on an already overburdened Post Office Department, and result in more efficient mail service.

Further results would be a decrease in material and labor now employed in preparing and producing the huge volume of Government mail, reduction in transportation handling costs, and, in general, a cut in federal expenditures.

* * *

Turning and Threading Speed Calculator

The Eastern Machine Screw Corporation, 142 Barclay St., New Haven 6, Conn., is distributing a handy device for calculating turning and threading speeds when the surface feet per minute and the diameter of stock are known. The chart contains on the back a table of suggested surface feet per minute for turning and threading different materials. From the speed selected in this table, the correct turning and threading speed can be quickly found by means of a rotating disk chart. The chart also shows the time required to make one piece with the given speeds, and the gross production per hour. A nominal price of 15 cents is charged for this calculator, as the supply is limited.

* * *

Nature provides food for every bird, but it does not throw it into the nest.—*Blueprints*

G.E. Develops Helium-Shielded Arc Welding

The General Electric Co., Schenectady, N. Y., has developed both manual and automatic arc-welding equipment specifically designed for the welding of magnesium, magnesium alloys, aluminum, and other high-strength light alloys under a protective shield of helium gas. The availability of such equipment will make possible extended use in war production of the lighter metals whose welding demands precise control of heat and protection of the molten metal from the oxidizing effect of the air.

One of the automatic units now in use at the General Electric welding laboratory makes a smooth clean weld under a shield of helium gas at rates up to 40 inches per minute on 1/8-inch stock. A specially designed electrode-holder is used, arranged to hold either a tungsten or a carbon electrode, to conduct the welding current into the electrode, and to surround the electrode with a stream of helium gas. The source of direct-current power for both manual and automatic welding is a standard G.E. direct-current arc-welding machine.

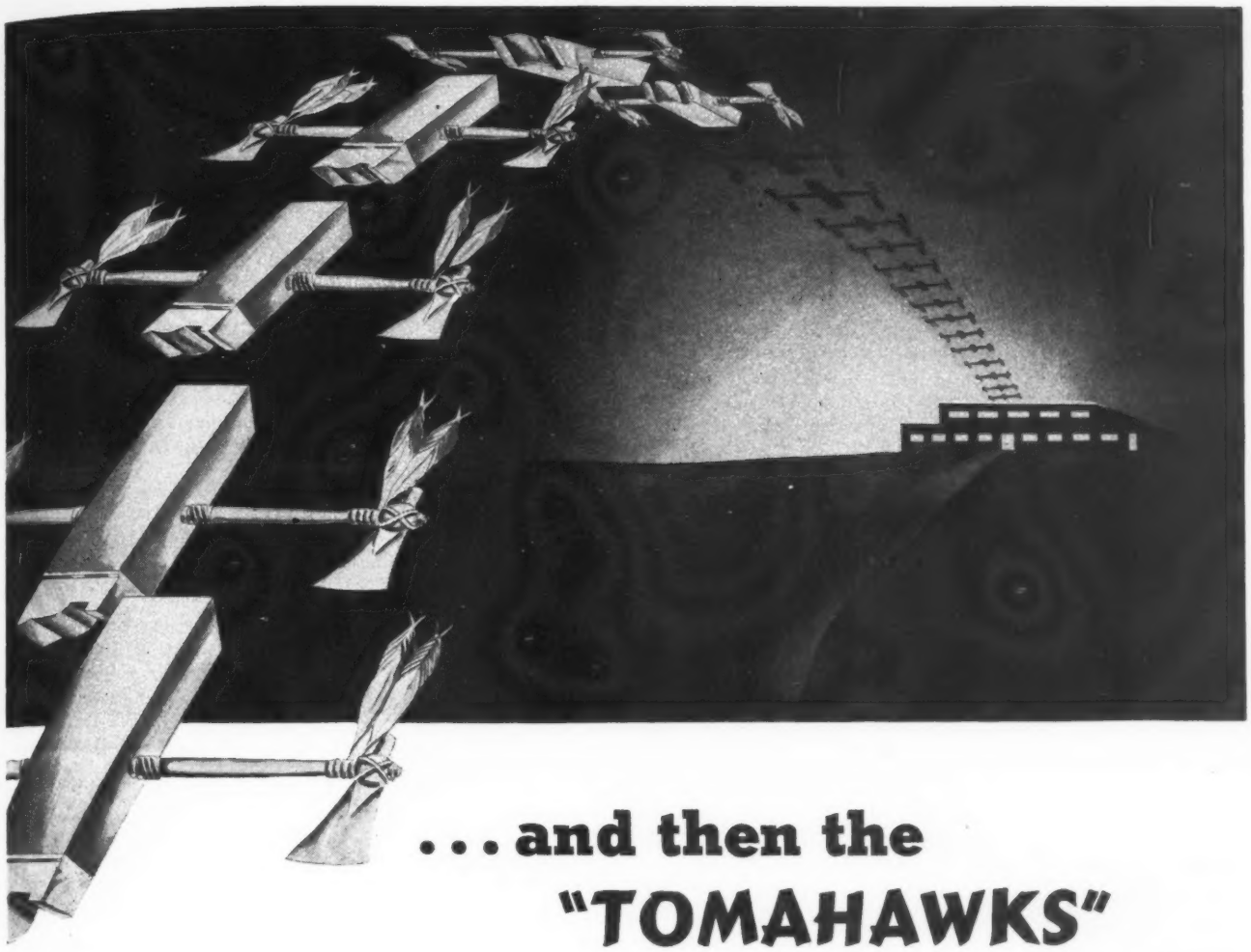
* * *

Color-Branding of Carbide Materials

The broad use of sintered carbides for cutting tools has resulted in the making of a considerable number of grades. Since these cutting-tool tips all look alike, the user needs a quick visual method of identifying the various grades. The Firth-Sterling Steel Co., McKeesport, Pa., has adopted what is called "color-branding," and has prepared a color chart to aid in selecting the right tip for each purpose. This color chart, suitable for shop use, can be obtained from the company upon application.

* * *

Invention is distinctly personal in character. All the great inventions are closely connected with the work of some individual. The race always makes progress through the individual and not through the mass.—*Dexter S. Kimball, formerly Dean of Engineering, Cornell University*



. . . and then the "TOMAHAWKS" came a-flying

YOU'VE READ many stories about how the Tomahawks licked the ME-110s, the Focke-Wulff 190s and Tojo's Zeros. But the chances are you've never heard how **"TOMAHAWKS"** helped to win one of the war's biggest battles.

These Tomahawks were not the Curtiss fighter planes known to every schoolboy of the United Nations, but Genesee **"TOMAHAWK"** cutting tools which — on the production front—have helped to win our first big battle, the battle of production.

These Tomahawks have come a-flying by the thousands and tens of thousands out of Genesee's three plants in Michigan's little town of Fenton. They tackle the toughest babies in the way of steels and bronzes and aluminum. Their pilots have not always been experienced—but these **"TOMAHAWKS"** like their flying namesakes have kept on and are keeping on cutting away, day after day and week after week—as part and parcel of the greatest production offensive success the world has ever known.

There is another battle Genesee has been helping to fight: The War on Waste. Its poster series—free to metal working plants in war industry—has been teaching workers the importance of conserving the vital materials used in cutting tools.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

GENESEE TOOL COMPANY

FENTON, MICHIGAN

* Registered Trade Mark

News of the Industry

California

A. J. Brown has been placed in charge of the Pacific Coast branch of the Whiting Corporation, Harvey, Ill. Mr. Brown's headquarters will be at 1151 S. Broadway, Los Angeles 15, Calif. He will supervise sales and engineering activity for all of the Whiting products in California, Oregon, and Washington. The company also announces the transfer of the aviation force from its former location at 6381 Hollywood Ave. to the headquarters of the Pacific Coast branch at 1151 S. Broadway, Los Angeles.

Frey Industrial Supply Co., 3828 Santa Fè Ave., Los Angeles, Calif., has been appointed representative in southern California for the complete line of gages and small tools made by the Taft-Peirce Mfg. Co., Woonsocket, R. I.

Accurate Machine Products Co. has been established at 1640 S. Hobart Blvd., Los Angeles, Calif., by J. W. Boening and W. J. Phelan to manufacture the countersink relief grinding fixture formerly made by the Industrial Grinding Co.

Frederick Post Co., Chicago, Ill., announces that the 20th Century Blueprint Co., 344 Bush St., San Francisco, Calif., will handle the complete line of Post drafting materials, blueprint paper, and other sensitized products.

Illinois and Indiana

Clearing Machine Corporation, 6499 W. 65th St., Chicago, Ill., manufacturer of hydraulic and mechanical presses, has recently established new sales and service offices in New York City and Cincinnati. J. R. Sheppard is in charge of the New York office, which is located at 30 Rockefeller Center. W. F. Dew is in charge of the Cincinnati office at 2107 Carew Tower.

Owen L. Holland has been appointed district manager of the Welding Division for the Chicago territory of the Metal and Thermit Corporation, 120 Broadway, New York City. Mr. Holland previously headed his own business handling welding specialties, and was called to Washington as chief of the Welding, Electroplating, and Equipment Branch of the War Production Board.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that the company will hereafter be known as Bowser, Inc. There will be no other change in the organization.

Massachusetts

Baldwin Locomotive Works, Philadelphia, Pa., have opened a new district office at 10 High St., Boston, Mass., under the managership of Wilbur H. Whitty. Mr. Whitty will direct sales in the New England area

Wilbur H. Whitty, Director of Sales in New England Area of Baldwin Locomotive Works

for all divisions of the company, including the Locomotive and Ordnance Division, Baldwin Southwark Division, Cramp Brass and Iron Foundries Division, Standard Steel Works Division, Baldwin De La Vergne Sales Corporation, and Pelton Water Wheel Co.

Michigan

P. F. Zerkle has been placed in charge of sales activities of the Michigan Tool Co., Detroit, Mich., manufacturer of gear production tools and equipment. The company is opening branch offices in both Cleveland and Dayton, Ohio, to provide better service to gear producers in those areas. The Cleveland branch will be located in the Penton Bldg., with George Pierce as district manager, and the Detroit branch will be at 710 Harries Bldg., with H. E. Roedter as manager.

Dorothy M. J. Tracey, vice-president of the Tomkins-Johnson Co., Jackson, Mich., manufacturer of air and hydraulic cylinders, die-sinking milling cutters, riveters, and air controls, has been appointed general manager. She succeeds the president, A. R. Johnson, in this capacity, enabling him to devote more of his time to the broad problems of manufacturing and sales.

Colonial Broach Co., Detroit, Mich., announces the opening of direct factory offices in South Bend, Ind., and Cincinnati, Ohio. T. S. Mellen has been placed in charge of the South Bend office at 601 Tower Bldg., and E. W. Brock will head the Cincinnati office at 1409 Union Central Life Insurance Co. Bldg.

Denham & Co., 812 Book Bldg., Detroit, Mich., have added to their staff Darrell W. Drury, formerly electrical engineer in charge of industrial fluorescent lighting for the Detroit Edison Co., and Eugene W. Nelson, formerly metallurgist with the Timken-Detroit Axle Co.

Saginaw Stamping & Tool Co., Saginaw, Mich., manufacturer of conveyor materials, casters, and trucks, announces that the firm name has been changed to Saginaw Products Corporation. This involves no change in the ownership or management of the concern.

New York

Burt H. Norem has been appointed Assistant Professor of Administrative Engineering in the College of Applied Science, Syracuse University, Syracuse, N. Y. From 1936 to 1938 Professor Norem was employed as a machine designer by the Taylor Forge & Pipe Works, Chicago, Ill., and subsequently served as methods engineer with Sears, Roebuck & Co. at its David Bradley plant, Kankakee, Ill.

Advance Pressure Castings, Inc., has recently moved its sales, engineering, and purchasing departments and technical laboratories to 894 Manhattan Ave., Brooklyn 22, N. Y. The plant remains at 34-48 N. 15th St., Brooklyn. The company also announces the appointment of George A. Meyer as general sales manager.

John R. Cassell Co., Inc., 110 W. 42nd St., New York City, dealer in drafting supplies and technical reproduction processes and materials, has established a new department which will be known as the Industrial Photographic Materials Department.

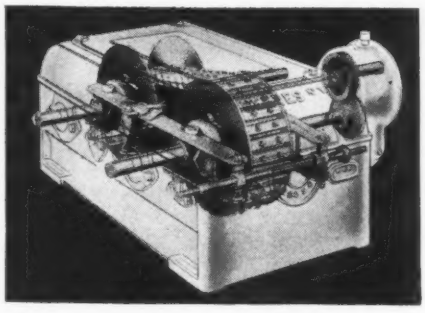
REEVES Transmission

Stepless Speed Adjustability and Speed Reduction in One Compact Unit

Here is a new REEVES Variable Speed Control unit, which consists of the widely preferred REEVES Variable Speed Transmission with built-in, helical-type speed reducer.

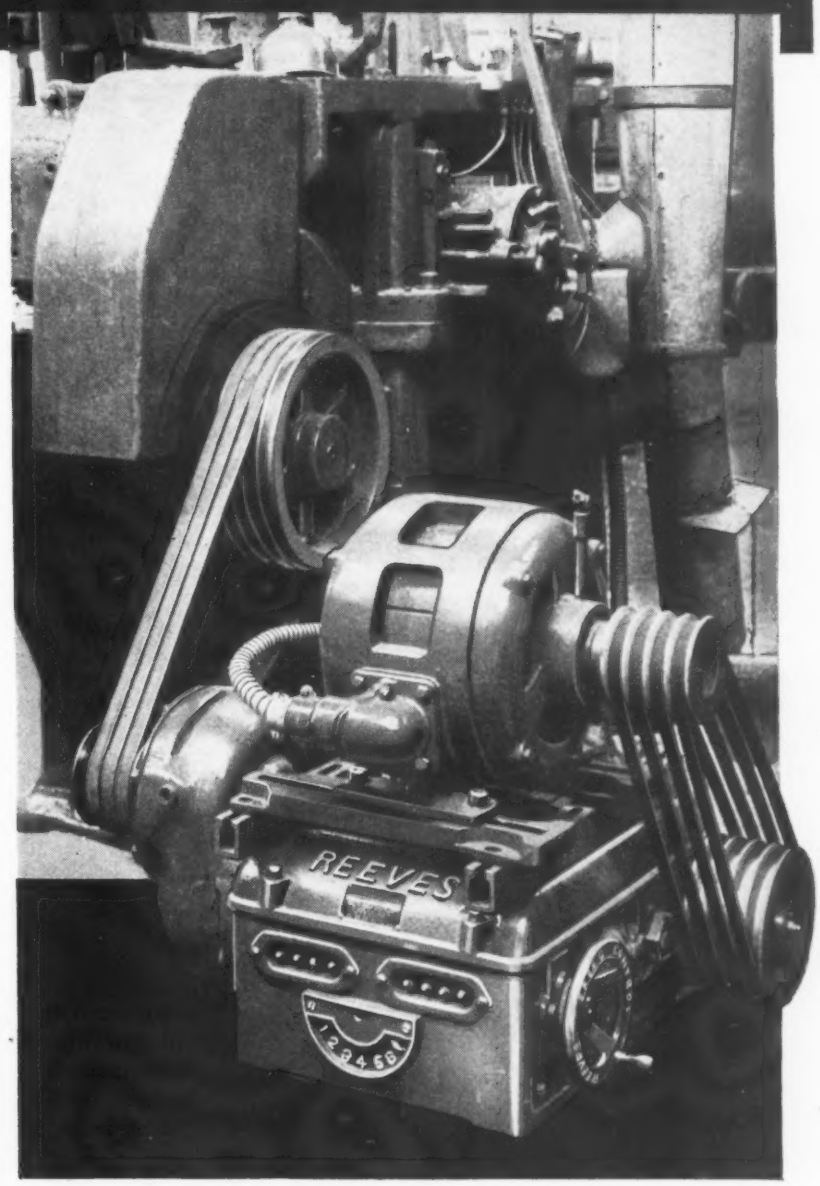
An outstanding advantage of this modern, highly efficient drive is that far less mounting space is needed to obtain the lower output speeds which formerly required the use of auxiliary speed reducing equipment.

The REEVES Reducer-Type Transmission is built in two completely enclosed designs —horizontal and vertical. Either of these designs is available in many different horse power capacities and ranges of speed variation, and may be mounted in almost any position on or near the driven machine. Either design may be equipped for individual motor drive by use of the REEVES adjustable motor base, as shown in the installation at right. Any available motor can be accommodated. Speed shifting controls may be handwheel, electric remote or completely automatic. Send for catalog MTR-432, giving complete information.



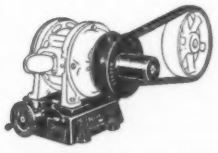
"X-ray" view shows how pinion of reduction gears is mounted on variable speed shaft of Transmission, this shaft serving as input shaft for reducer unit.

REEVES PULLEY COMPANY
COLUMBUS • INDIANA

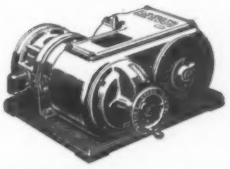


THE 3 BASIC UNITS IN THE REEVES LINE

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range, 2:1-16:1. To 87 h.p.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. In sizes to 15 h.p.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in a single unit. In sizes to 10 h.p. capacities.

REEVES Accurate Variable SPEED CONTROL

E. KARELSEN, INC., manufacturer of diamond-pointed and tungsten-carbide tools, announces that the firm has just moved into a large modern plant at 125 W. 45th St., New York City. The new quarters will give the company more than six times its former capacity.

LAWRENCE B. JACKSON has been appointed director of engineering of the Diesel Division of the American Locomotive Co., 30 Church St., New York City. Mr. Jackson previously held a similar position with Fairbanks, Morse & Co.

ERIC E. BACKLUND has been advanced from the position of assistant sales manager to sales manager of Goulds Pumps, Inc., Seneca Falls, N. Y. He became connected with the company in 1923.

W. E. ADDICKS has been appointed manager of the New York district office of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturer of electrical products.

New Jersey

A. AMUNDSEN, works manager of the Wright Aeronautical Corporation, New York City, for the last ten years, has been made manager of that company's newest warplane engine plant, which is located in northern New Jersey. Previous to becoming connected with the Wright organization, Mr. Amundsen was factory superintendent of the Sperry Gyroscope Co. for fifteen years.

ELASTIC STOP NUT CORPORATION OF AMERICA, Union, N. J., has been awarded a war production citation by the Ordnance Department Industry Integration Committee for Tank Trucks.

GORDON WYGANT has been appointed field service manager for the Titeflex Metal Hose Co., Newark, N. J.

Ohio

DETROIT TAP & TOOL CO., Detroit, Mich., announces the opening of a factory branch office at 1506 Toledo Trust Bldg., Toledo, Ohio. M. TEAGUE and W. F. HAVERSTOCK are the service engineers at the new office. The company also announces that it has recently expanded its lines considerably, which now include tapping machines, tap reconditioners, and thread milling cutter checking equipment, in addition to precision ground thread production tools and gages.

FRED T. TURNER, formerly Pittsburgh representative of the Osborn Mfg. Co., Cleveland, Ohio, and PAGE A. MEAD, representative of the company in eastern New York State, have been transferred to the Cleveland headquarters for special assignments. PRESLEY KATZ, Chicago representative, will replace Mr. Turner at Pittsburgh, and DEAN M. BOUNDY will take Mr. Mead's place in eastern New York. LLOYD H. ROSS will succeed Mr. Katz at Chicago.

WILLIAM A. SHULZ has recently joined the Chicago Sales Division of the Industrial Tool Division, Aro Equipment Corporation, Bryan, Ohio. THOMAS O'MALLEY has been appointed division manager in the New England territory of the Industrial Pneumatic Tool Division of the company, with headquarters in Hartford, and JAMES LITTLETON has been made division manager in the southern Ohio territory, with headquarters in Dayton.

WILLIAM FISGUS, night superintendent with the Cincinnati Planer Co., Cincinnati, Ohio, has been promoted to the position of general superintendent, and will take over the duties of OSCAR C. WILLEY, day superintendent, who has been appointed tool engineer, succeeding R. J. Griese. GEORGE LA MOTH has been made active works manager of the Cincinnati Planer Co. and will head manufacturing for the company.

TINKHAM VEALE II has been appointed production manager of the Tocco Induction Process Division of the Ohio Crankshaft Co., Cleveland, Ohio. Mr. Veale was previously assistant to the president in charge of production control records, and prior to joining this company, was connected with the Reliance Electric & Engineering Co. of Cleveland as Detroit sales-engineering representative.

WARNER & SWASEY CO., 5701 Carnegie Ave., Cleveland 3, Ohio, announces that it has re-opened its rebuilding department, and is now in a position to provide owners of Warner & Swasey turret lathes with complete rebuilding service. This service was temporarily discontinued to meet the needs of the war production program.

O. J. SCHROEDER has been appointed vice-president in charge of manufacturing, equipment, and engineering for the Save Electric Corporation, Toledo, Ohio. Mr. Schroeder was previously superintendent of the Lamp Division of the Westinghouse Electric & Mfg. Co., at Bloomfield, N. J.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces that the plant guards of the company were recently awarded the Auxiliary Military Police Guidon. This award is given for excellence in plant security, and was presented by the Fifth Service Command.

WHITLEY B. MOORE has been appointed director of sales for all divisions of the Timken Roller Bearing Co., Canton, Ohio, and will be succeeded in his present capacity of general manager of sales of the Timken Steel & Tube Division by C. H. MCCOLLAM.

WALTER L. SEELBACH, secretary-treasurer of the Forest City Foundries Co., Cleveland, Ohio, was elected president of the Gray Iron Founders' Society at the annual convention of the Association held in Cincinnati in October.

HARRISON R. TUCKER, aircraft engineer and inventor of numerous improvements in aircraft and accessories, has recently become director of the Aircraft Engineering Division of Designers for Industry, Inc., Cleveland, Ohio.

R. S. ARNOLD has been made assistant to M. R. MINNICH, sales manager of the American Welding & Mfg. Co., Warren, Ohio. Mr. Arnold was formerly manager of the Ideal Foundry Division of the Republic Steel Corporation at Newton Falls, Ohio.

RAYMOND J. GRIESE has been appointed works manager of the Boyé & Emmes Machine Tool Co., Cincinnati, Ohio, succeeding the late George A. Mohr. Mr. Griese was formerly tool engineer with the Cincinnati Planer Co.

CLEVELAND TOOL ENGINEERING CO. has moved into new and larger quarters at 1259 W. 4th St., Cleveland 13, Ohio, with increased facilities for the manufacture of circular relief grinders and universal indexing heads.

LIONEL M. SEARLE, for the past year manager of the Monroe St. plant of the Simplex Radio Division of Philco Corporation, Sandusky, Ohio, has been made manager of the entire division.

Pennsylvania

ROY A. HUNT, president of the Aluminum Co. of America, Pittsburgh, Pa., was presented with the A.S.M. Medal for the Advancement of Research at the annual dinner of the American Society for Metals, held at the Palmer House in Chicago on October 21. At the same time, DR. ZAY JEFFRIES, technical director of the lamp department of the General Electric Co., Cleveland, Ohio, received the Gold Medal of the society in recognition of his outstanding metallurgical knowledge and his great versatility in the application of science to the metal industry.

THOMAS I. PHILLIPS, vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been ap-

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

Out of America's tremendous war effort will come amazing new developments-- a new mode of living. LAKE ERIE will supply industry with Hydraulic Presses that will make this mass production possible.

Thomas I. Phillips, Newly Appointed Head of Westinghouse Pittsburgh Divisions

pointed head of the company's Pittsburgh divisions, succeeding A. C. STREAMER, who has been made assistant to the president with headquarters in Pittsburgh. Mr. Phillips became connected with the Westinghouse organization in 1915 as a toolmaker and was rapidly advanced to positions of greater responsibility until, in 1941, he was elected vice-president. In 1937, he was awarded the Order of Merit by the board of directors in recognition of his outstanding work.

T. W. PENNINGTON has been appointed vice-president in charge of sales of the Jessop Steel Co., Washington, Pa. Mr. Pennington previously held the position of general sales manager of the company.

T. W. Pennington, Vice-president in Charge of Sales, Jessop Steel Co.

J. FREDERIC WIESE was elected a vice-president of the Lukens Steel Co., Coatesville, Pa., at a recent meeting of the board of directors. He will have charge of the combined sales of the Lukens Steel Co. and its subsidiaries, the By-Products Steel Corporation and Lukenweld, Inc. He was previously manager of combined sales for the company and its subsidiaries.

GROSVENOR S. MCKEE, formerly works manager of the three plants of American Type Founders, Inc., at Elizabeth, N. J., has become vice-president and works manager of the Erie and Meadville, Pa., plants of Talon, Inc. Mr. McKee is returning to an association with Talon, Inc., having served as production manager of that company from 1938 to 1942.

C. O. JUDD, who has been representing the Quaker Chemical Products Corporation, Conshohocken, Pa., as a metal process engineer in Chicago, Ill., has been transferred to Cincinnati to fill the position made vacant by the death of HAROLD G. HOBBS. M. A MACKAY, formerly located in Syracuse, N. Y., will take Mr. Judd's place in Chicago.

RICHARD P. BROWN, chairman of the board of the Brown Instrument Co., Philadelphia, Pa., and vice-president of the Minneapolis-Honeywell Regulator Co., has been named deputy director of the War Production Board for the Third Region.

* * *

List of Alien Patents Available

Approximately 50,000 alien patents and applications are now available to American manufacturers. A list of these patents has been prepared by Origination, Inc., Wrigley Bldg., Chicago, Ill. The list has been segregated into 300 portfolios, each of which contains all the U. S. Patent Office publications dealing with the patents applicable to a particular field. Licenses for any of the patents can be secured from the Patent Office through this concern. Further information can be obtained from the company.

* * *

Renegotiation is a fancy name for a very old and much abused policy that progressive manufacturers, Government, and labor leaders will not countenance when applied by industry. The old name for it was piece-work rate cutting. However, when applied today by the Government to an efficient industrial organization, it is presumed to be a highly respectable procedure.

Obituaries

William R. Beatty

William R. Beatty, founder of the Beatty Machine & Mfg. Co., Hammond, Ind., died on September 8 at his home in Hammond, aged sixty-six years. He had been active up to a short time before his death in the management of the concern that he founded twenty-six years ago.

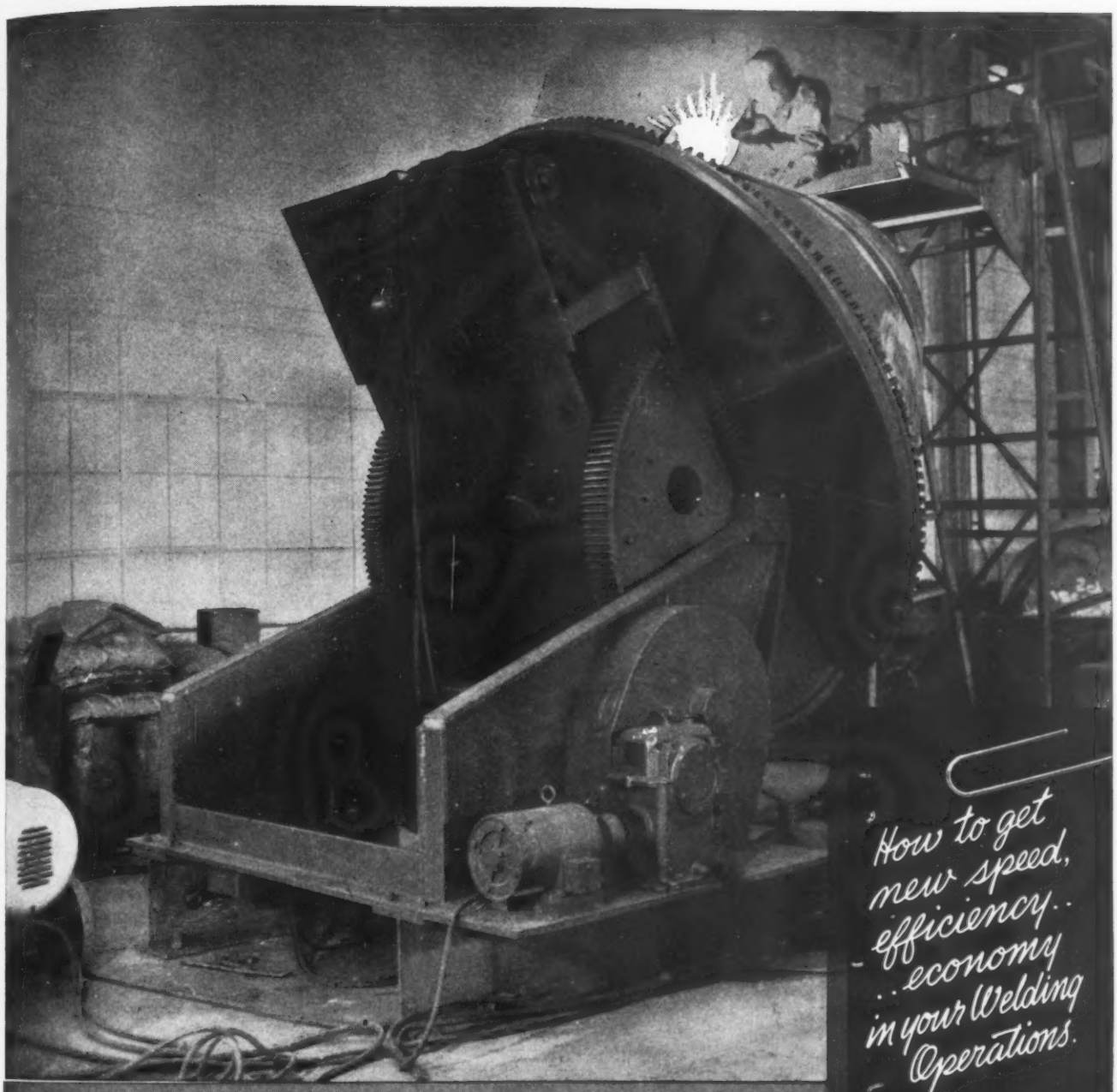
As a young man, Mr. Beatty worked with an iron and steel concern in Pittsburgh, Pa., and later became general superintendent of the New Castle

William R. Beatty

Forge & Bolt Co. at New Castle, Pa. Subsequently he was associated with the Williams-White Co. of Moline, Ill., in the capacity of Chicago sales manager. In 1917, he organized his own business, manufacturing heavy metal-working machines. His son, L. C. Beatty, president of the concern, will carry on the business.

Herbert John Wills

Herbert John Wills, of the sales engineering staff of the Carborundum Co., Niagara Falls, N. Y., died on September 20. Mr. Wills joined the Carborundum organization in 1920 as a member of the plant maintenance department staff. In 1929, he was transferred to the abrasive engineering department and assigned to the development of applications of a series of lapping compounds. Later he extended his efforts to surface finishing produced by grinding, as well as lapping. His study of grinding problems has added much to the progress that has been made in this field, and he was recognized as one of the authorities



How to get new speed, efficiency... economy in your Welding Operations.

WHITING *Special* WELDING POSITIONER

Backed by many years of experience developing positioners and special fixtures for welding and other requirements, Whiting is in a position to offer a complete engineering service on this type of equipment.

QUICKWORK DIVISION

WHITING CORPORATION

on surface finishes. He wrote and collaborated in the writing of many booklets and articles published in the technical press, including the series now being published in MACHINERY on "How to Secure Fine Surfaces by Grinding." Mr. Wills was secretary of the Committee on Surface Finishes of the American Society of Mechanical Engineers.

Mr. Wills is survived by his widow, Mina Bennett Wills; two married daughters; and a son, Robert, now in the United States Marine Corps.

GEORGE T. HOWARD of the Pratt & Whitney Chicago office died on September 24 at the age of thirty-nine years. Mr. Howard was a sales engineer for the Pratt & Whitney Co., handling small tools and gages, and had wide contacts and many friends throughout the Chicago area. He had been associated with the company since September 1933, and started his work as sales engineer in February, 1935.

HAROLD G. HOBBS, a metal process engineer with the Quaker Chemical Products Corporation, Conshohocken, Pa., died on August 28. Mr. Hobbs joined the Quaker organization in March, 1941, and at the time of his death was a district manager in Cincinnati and the surrounding area.

CARL E. JOHANSSON, well known in the mechanical field throughout the world by his invention and development of what were originally known as the Swedish gage-blocks, recently died in Eskilstuna, Sweden, at the age of seventy-nine years.

* * *

Another Remarkable Service Record

Joe Wessiack, who is employed by the Continental Screw Co., New Bedford, Mass., has never been late or absent from work during his thirty-six years with the company. There can be no greater challenge to absenteeism than this remarkable record. The men who will win this war, whether on the battlefront or on the production front, are those possessed of such an unfailing spirit of responsibility.

* * *

National Security Award

The U. S. Office of Civilian Defense has established a National Security Award to recognize those industrial plants that have developed exceptional safeguards against fire, sabotage, accidents, or air attack. Details relating to this award can be obtained from the U. S. Office of Civilian Defense, Washington 25, D. C.

New Books and Publications

DIE ENGINEERING LAY-OUTS AND FORMULAS. By C. W. Hinman. 497 pages, 6 by 9 inches; about 400 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $5.

The author of this book was formerly chief of jig and fixture design with the Western Electric Co., Chicago, Ill., and chief tool designer of the Automatic Electric Co., Chicago. This book aims to combine the basic mechanical principles of assembled die designs with their operating details, to give the necessary mathematical formulas for laying out dies, and to emphasize the need for a clear drafting representation. The main part of the book is devoted to what are known as "key designs," designs of specific types covering important principles. In addition, some of the more important groups of these key designs have been repeated with a wide variety of lay-outs. As an example may be mentioned the many drawings and photographs given of progressive dies and of cut-and-carry types of dies. Part of the material has been selected from some of the author's recently published articles in the technical press. In addition, many original illustrations and descriptions are included.

SLIDE-RULE SIMPLIFIED. By Charles O. Harris. 250 pages, 5½ by 8¼ inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price $2.50 (including slide-rule, $3.50).

This book gives simple instructions for the use of the slide-rule by means of which it is believed that anyone who will take time to study the instructions and practice can learn to use this instrument easily. Complete instructions are included on how to read the different scales of the slide-rule accurately and precisely, and thus forestall serious errors. Each type of calculation is so clearly and thoroughly explained that it can be easily mastered by the reader who studies alone, as well as by those who study in the class-room. The material in the final chapters will be of interest to students who have had previous experience with the slide-rule. These chapters deal with sines and cosines, the tangent of an angle, and logs and antilogs.

ENGINEERING MECHANICS. By Ferdinand L. Singer. 482 pages, 6 by 9 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $4.

This book has been prepared by the author, who is assistant professor of engineering mechanics at New York University, for use by engineering students and engineers having a thorough grounding in mathematics, including calculus. The principal chapters of the book deal with Principles of Statics; Resultants of Force Systems; Equilibrium of Force Systems; Analysis of Structures; Force Systems in Space; Friction; Centers of Gravity; Moments of Inertia; Principles of Dynamics; Rectilinear and Curvilinear Translation of Motion; Rotation; Plane Motion; Work and Energy; Impulse and Momentum; Mechanical Vibrations; and Graphic Methods.

FOREMANSHIP AND ACCIDENT PREVENTION IN INDUSTRY. 94 pages, 5 by 7½ inches; numerous illustrations. Published by Engineering Department, American Mutual Liability Insurance Co., Boston, Mass. Available on request to executives of plants engaged in war work.

While a great many books have been published on accident prevention in industry, it is felt that a book on this subject addressed directly to the foreman will meet a distinct need at the present time. This book deals in non-technical fashion with a difficult subject. While it does not avoid theoretical principles when these are necessary, it is especially prepared with the purpose of presenting practical information. The section on women workers is particularly timely.

STUDIES IN ARC WELDING — DESIGN, MANUFACTURE, AND CONSTRUCTION. 1295 pages, 6 by 9 inches; over 1000 illustrations. Published by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Price, $1.50 in the United States; $2 elsewhere.

This book contains a collection of ninety-eight outstanding papers on arc welding submitted in the James F. Lincoln Arc Welding Foundation's 1940-42 Industrial Progress Award Program. This collection of arc-welding design applications and welding data represents the work of 113 engineers, designers, works managers, superintendents, foremen, and other technicians. The book is divided into nine sections dealing with welding data in the following fields: Automotive, aircraft, railroad, watercraft, structural, furniture and fixtures, commercial welding, containers, and machinery.

METALS AND ALLOYS DATA BOOK. By Samuel L. Hoyt. 334 pages, 7 by 10 inches. Published by the Reinhold Publishing Corporation, 330

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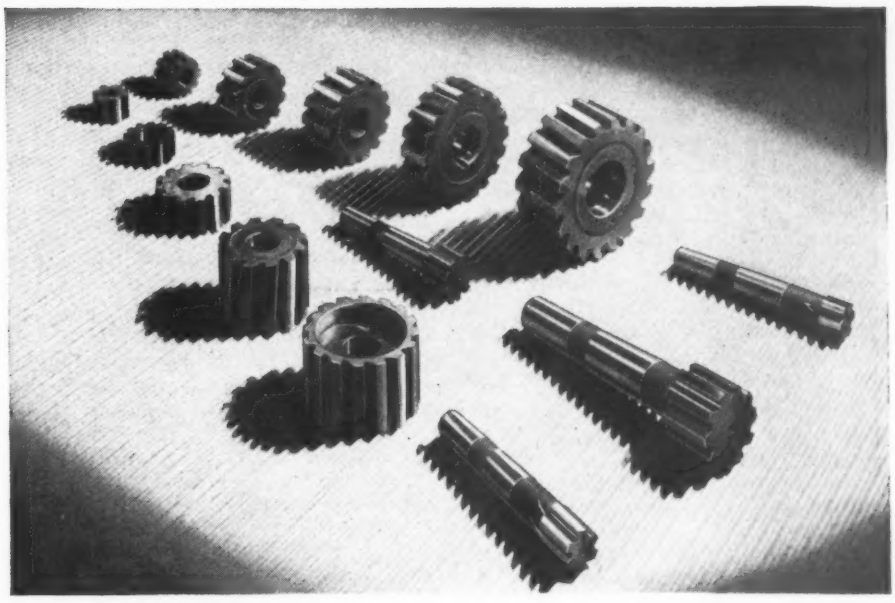

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This book contains a great deal of data on all types of metals and alloys, their strength and other physical properties, heat-treatments, etc. Most of the information is given in tabulated form, the book containing 340 tables. It is divided into sections or chapters dealing with test specimens and hardness tests; then follows specific information on different types of steels. Special sections are given to cast steels and stainless steels, and to cast irons, heat- and corrosion-resistant alloys, and non-ferrous alloys.

SHOP MATHEMATICS. By Arthur A. Dick. 230 pages, 5½ by 8 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $2.40.

This book is the result of the author's experience in organizing courses of instruction as coordinator of vocational war production training for Baltimore County, Md. The material selected is especially suited for students pursuing vocational courses. It is divided into brief lessons or units arranged in logical sequence. The book appears to be best suited as a school text-book where an instructor is available, in which case it will also prove useful as a guide for the instructor in selecting fundamental applications.

MANAGEMENT OF MANPOWER. By Asa S. Knowles and Robert D. Thomson. 248 pages, 6 by 8½ inches. Published by the Macmillan Co., 60 Fifth Ave., New York. Price, $2.25.

This book deals in detail rather than in generalities with the subject of personnel management. In a brief review, the best conception of the scope of the work can be given by mentioning some of the subjects dealt with: Organization and morale; safety and health; plant lay-out and safety; selection and training; motion study and the worker; motion study and plant lay-out; time study; job evaluation; merit rating; measuring manpower performance; employe compensation.

MATHEMATICS FOR MACHINISTS. By R. W. Burnham. 253 pages, 5 by 7 inches; 186 illustrations. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.

This is the second edition of a book published several years ago to provide the beginner in machine shop work with a text-book giving not only the ordinary elements of arithmetic, but also its application to the most commonly required machine shop calculations. The author is principal of the Haaren High School, New York City, and has thus had an opportunity to adapt his book specifically to the instruction of students concerned with the elements of machine shop practice.

ELECTRICAL AND RADIO DICTIONARY. By Carl H. Dunlap and Enno R. Hahn. 110 pages, 5½ by 8½ inches; numerous illustrations. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $1.

This is a revised and enlarged edition of a book originally published in 1927, giving symbols, formulas, diagrams, and tables for electrical and radio work. It provides a convenient reference book for anyone interested who is not thoroughly familiar with electrical terms and symbols.

STUDENTS' MANUAL OF GRAY MARINE DIESELS. 259 pages, 8½ by 11 inches; 407 illustrations. Published by the Gray Marine Motor Co., Detroit, Mich. Price, $3.50.

This book is intended to cover the operation and maintenance of Gray marine Diesel engines, but obviously contains a great deal of information useful to the student of Diesel engines in general. The book contains a detailed description of every part of the engine, and gives complete operation and maintenance instructions.

HELICAL MILLING. By C. A. Felker and H. W. Paine. 86 pages, 6 by 9 inches. Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee, Wis. Price: Paperbound, $1; cloth-bound, $2.

The object of this book is to present the fundamentals of helical milling and a detailed study of different types of helical milling procedures, ranging from the simplest to the most advanced. Practical problems are included.

SPUR GEARING. By W. M. Owen. 61 pages, 6 by 9 inches; 26 illustrations. Published by McKnight & McKnight, 109 W. Market St., Bloomington, Ill. Price, 72 cents.

The author, who is training supervisor of the Caterpillar Tractor Co., has presented, in this book, the fundamentals of spur gear design and dealt with a few of the theoretical points in as simple a manner as possible, as a basis for the understanding of the principles underlying spur gearing.

HERON ESTIMATING TABLE FOR LATHE WORK. By Raymond Heron. Published by the author, 91-18 183rd St., Jamaica, 3, N. Y. Price, $1.

This table gives the time required for performing work on the lathe when the type of material, dimensions, cuts, and feeds and speeds are known.

EFFECT OF COLD DRAWING ON MECHANICAL PROPERTIES OF WELDED STEEL TUBING. By Winston E. Black. 34 pages, 6 by 9 inches. Published as Bulletin No. 341 of the Engineering Experiment Station, University of Illinois, Urbana, Ill. Price, 40 cents.

WIRE ROPE. Simplified Practice Recommendation R198-43. 20 pages, 6 by 9 inches. Published by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Price, 10 cents.

RECOMMENDED PRACTICE FOR THE SPOT AND SEAM WELDING OF LOW-CARBON STEEL. 4 pages, 6 by 9 inches. Published by the American Welding Society, 33 W. 39th St., New York City. Price, 10 cents.

Coming Events

NOVEMBER 3-4—Annual meeting of the MEEHANITE RESEARCH INSTITUTE OF AMERICA at the plant of the Cincinnati Milling Machine Co., Cincinnati, Ohio.

NOVEMBER 16-17—Production Conference of AMERICAN MANAGEMENT ASSOCIATION, at the Hotel New Yorker, New York City. For further information, address American Management Association, 330 W. 42nd St., New York 18, N. Y.

NOVEMBER 29-DECEMBER 3—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 2-4—Joint meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS AND THE APPLIED MECHANICS DIVISION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. For further information, address the Society for Experimental Stress Analysis, P. O. Box 168, Cambridge 39, Mass.

DECEMBER 6-11—NINETEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Madison Square Garden, New York City. For further information, address International Exposition Co., 480 Lexington Ave., New York City.

JANUARY 10-14, 1944—Annual meeting and engineering display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 25-28, 1944—THIRD WAR PRODUCTION FOUNDRY CONGRESS and FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

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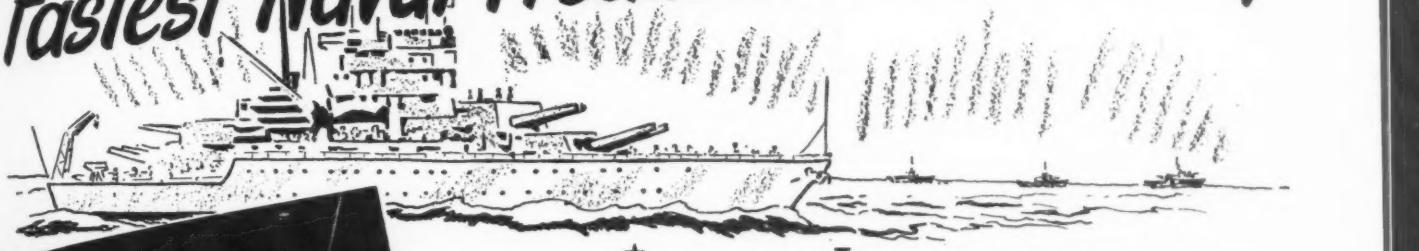

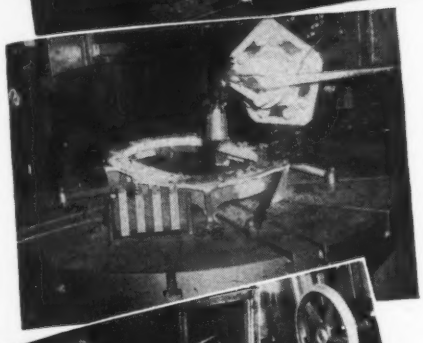

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In Industry! Typical of the way carbides are helping to speed production of hundreds of parts in industry for naval use is this job of machining cast steel pinion bearings for main drives of destroyers. Cutting at 220 feet per minute, Carboloy tools reduce machining time at least 25%.

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In Navy Yards! In the Navy Yards, too, carbide tools are a vital factor in helping speed production. At Portsmouth Navy Yard, for example, Carboloy tools machine cast steel frames for watertight doors on submarines at speeds 100% faster than before. For this intermittent cutting job, Carboloy grade 78-C tools cut at 150-175 F.P.M., .032" feed, with varying depth of cut up to 3/16".

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In Naval Ordnance Plants! Here again carbide tools have a job to do—and are doing it! Typical is the milling of steel breech casing at a midwestern U. S. Naval Ordnance Plant. Carboloy mills—operating at 650 S.F.P.M., 7½" table travel—eliminate one milling machine and two grinders through faster operation and better finish obtained.

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On the High Seas! When repairs are needed far from port—the Navy is prepared! "Floating" machine shops with modern, efficient equipment—including carbide tools—are a standard part of large Naval vessels.

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